Photograph by F. E. MacKnight, Chief Engineer Southeastern Underwriters' Association.

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The Quarterly

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The Annual Meeting. The thirteenth annual meeting held in New York City the last week in May was in some respects the most successful in the history of the Association. The published Proceedings sufficiently indicate the substantial character of the technical portion of the deliberations; but they only suggest indirectly the no less important social values of the meeting. Organizations which have lived through the years of heavy preparatory plodding, and whose function is now principally to keep abreast of progress in the domain of their special activities, may do well not to pack their programs too full of technical papers. This point of view is finding expression in the programs of the annual conventions of quite a number of the national engineering bodies, which have found that the time devoted to the informal interchange of ideas is by no means the least profitable. There are many points in fire protection engineering of especial value to certain individual members who hesitate to project the same into any formal discussion. To such as these the intermissions and the social functions, affording opportunity for individual conversations, have a value all their own. The May meeting was full of such opportunities, not the least of which was the dinner generously given to our entire visiting membership by the Insurance Society of New York, at which there was much good fellowship and some very good speaking by the officers and members of both organizations. The exhibitions the following day of the high pressure pumping system and its water-throwing at Gansevoort Square, and the fire boats in the North River, afforded another diversion replete with interesting educational suggestions.

Conflagration Possibilities in New York. The item far and away the leader at this year's meeting was concrete construction. The development of the modern city has hoisted the subject of non-burnable buildings into very proper prominence, and the proposed new building code for the city of New York being already on the way, the local interest was naturally keen. One may not be pre-

pared to endorse the interesting assertion that the population of Manhattan travels daily a greater distance vertically than it does horizontally; but with the completion of every additional skyscraper it comes nearer to being true. Considering the housing capacities of the great office buildings one shudders to think of the result of any holocaust, or even panic, in the congested districts, that would precipitate, all at once, the emptying of the human contents of these buildings into the narrow and crooked streets. The opinion of the manager of one of the big fire insurance companies, Mr. C. F. Shallcross, expressed at the second public hearing on the proposed new building code, to the effect that New York City might be the scene of the world's greatest conflagration, is not at all extravagant. "Its narrow streets, gigantic buildings and entire scheme of construction are calculated to make difficult the checking of a fire once it gets a grip upon the city's heart," said Mr. Shallcross. Indeed, cannot the imagination easily picture a wind-driven fire sweeping through the upper stories of the skyscrapers, communicated from one to the other far above the heads of the panic-stricken populace—far above any effective fire-fighting from the outside? Failure of water supply or electric service, putting elevators out of commission, would pack humanity upon the narrow stairways of some of these buildings where they would be roasted like cattle. The importance of making such a conflagration unlikely, if not impossible, can hardly be over-estimated.

Limiting Building Heights. It is too late for New York to set a reasonable limit to the height of her buildings. Her transgressions are already so far beyond balanced requirements of public safety that any limit finally agreed upon and set by law must remain extravagant. The physical limitations of Manhattan Island areas and the consequent enormous site values have encouraged heavy investment in skyscrapers. Any steps retraced toward reasonable restriction can be none other than a compromise, unsatisfactory alike to the land owners who wish to follow the illustrious examples already set and to the public gradually awakening to a consciousness of its daily danger. New York City must work out her salvation as best she may; her problem is peculiarly her own. It is not too late however to impose desirable checks upon this sort of madness in other cities. Boston has already done so. The recent decision of the United States Supreme Court sustaining the Supreme Court of Massachusetts in upholding the validity of a state's power to impose limitations on the heights of buildings or to grant similar power to municipalities, means that Boston is to have no more structures over 125 feet in height. The zeal of the Bostonians in fighting this matter through to the court of last resort figures as a national service. It remains now for other states merely to exercise their legally recognized police functions and make their formal declarations.

Fire Fighting in Skyscrapers. Few who have not considered the problem realize the difficulty of extinguishing fire in a skyscraper. It is obvious that water thrown from the outside, from hose nozzles in the street far below, is practically wasted. Even if it

reaches the story in which the fire is burning, the acute angle at which it is thrown prevents the water from falling more than a foot or two within the window opening. Fires in skyscrapers must be fought from inside. This means at the very least an equipment of chemical extinguishers and a standpipe with suitable hose and hose connections on every floor. Firemen cannot carry hose up twenty stories of winding stairs and get it coupled, and water in it, in time to be of any service. They must find their 2½-inch hose ready for them on the floor where the fire may be, or the floor above or below it. It is clearly the opinion of the well-informed that none but an experienced fire-fighter can handle a 2½-inch hose with the water at any considerable pressure. This means then that if the tenants of the building do not succeed in promptly extinguishing the fire with the chemicals, they can do nothing further until the arrival of the department, unless there is a second equipment of hose of smaller diameter, as there should be. A supplementary equipment of 1½-inch hose may enable those in the building to hold the fire in check, until the firemen arrive.

No matter how "fireproof" the structure itself may be, the contents are always inflammable, or at least combustible, and if fire cannot be promptly extinguished in the room in which it originates, the halls of the stories above quickly fill with smoke, and the inevitable rush and panic take place; when it is difficult for any except the coolest and bravest to do anything effective.

Standpipes and hose presuppose an adequate water supply, at pressure sufficient to make it available even on the top story. If this pressure is to be supplied by a city high pressure system or an outside steamer connection, delay is involved. The alarm must go in before the city high pressure service responds, and the engines must arrive before the outside steamer connection is available. A high pressure fire pump in the building itself is the best solution.

There are now many of such equipments in New York City, and in Chicago there are at least one hundred buildings in the down-town district equipped with inside standpipes and private pumps.

Chicago Has Plans. Pending the adjustment of the matter of Chicago's bonded indebtedness looking toward a municipal high pressure system, a very positive effort is making in that city toward increase of the number of these private high pressure equipments, by including in the new building ordinance now under way a requirement for the installation of high pressure pumps in all buildings over 100 feet in height. The engineer of the Chicago Board of Underwriters has prepared a tentative ordinance requiring a standpipe and hose equipment for all buildings six stories or more in height and with 5,000 or more square feet of ground area, unless equipped with automatic sprinklers. This is to be attached to electrically driven centrifugal pumps, with a capacity of not less than 500 gallons per minute for the minimum equipment, the pumps to be directly connected to a motor, properly installed and protected so that it can be started by touching a button. This will provide water under pressure at once when needed, without the expense of constantly keeping up

steam for a steam-driven pump. The ordinance also provides for steamer connections and for connections with hose on each floor. This would practically provide a high pressure system all through the down-town district and would protect several hundred buildings in which the fire department is now unable to cope with fire in the upper stories until it has carried hose.

That Chicago needs better fire protection of some sort, and needs it badly, is evidenced by the amount of her losses for the first half of the current year which cost the underwriters alone $3,315,785, or nearly $350,000 more than the same period last year. It looks as if the average of a five million dollar ash-heap were to be maintained for at least another year, for the above figures do not include the losses borne by the uninsured.

What of the Future? Such continual and resistless burnings as these in Chicago, which are yet characteristic of the entire country, would bring a feeling of hopeless discouragement were it not for the knowledge that the people are being gradually roused to combat the long careless sowings which are still yielding such a disastrous harvest. As Mr. Montgomery Hare of New York has well said, "the significance of the facts now disseminated is gradually impressing itself upon municipal authorities; the necessity for remedial measures is more generally recognized than ever before." At no period in the thirteen years of our work and agitation has the outlook been so hopeful. The United States government, through the Technologic Branch of the Geological Survey has extended its horizon beyond our natural resources and is now considering our created resources as well; and the fire-waste figures compiled by Chief Engineer Herbert M. Wilson, who was present and shared the discussions at our May meeting, are sufficiently imposing to impress almost anybody. The government is not satisfied to reckon up the size of the annual national ash-heap merely; it includes in its figures such items as insurance premiums and maintenance of fire departments and calmly points out to the American people that their annual fire waste is more than $450,000,000.

Another movement of favorable import is the interest which the National Association of Credit Men, a very influential organization, is now taking in the fire waste, which, it may be suggested, is a matter not wholly remote from the domain of sound credits. It will be remembered that Mr. W. H. Merrill of Chicago addressed the members of this body on the subject of fire prevention at their annual convention of last year in Buffalo. Other prominent members of our Association do not hesitate to leave their desks and sally forth to break a lance in the good cause—witness Mr. Frank Lock's splendid speech before the Richmond Chamber of Commerce last month.

It may be that we shall not immediately succeed in leading the people to so high a standard as was advocated by certain of our influential members before the Building Code Committee in New York. To ask that all buildings over 60 feet in height be wholly incombustible, even to the door and window frames and other trim, is yet a far

cry from the habit of mind of the average American builder. And yet it is an idea and a recommendation so eminently and entirely sane that some day New York may remember it and wish she had taken it more seriously.

The New Offices N. F. P. A. This issue of the Quarterly is sent out from the new offices of the Association at 87 Milk Street, Boston. The Editor's office formerly in Hartford, and the Secretary's office formerly in Chicago, are now united at Boston with the desirable result of a considerable saving in correspondence. Ample storeroom facilities are afforded in connection with the new offices and all publications of the Association are now neatly stored on accessible shelves. The offices consist of two rooms, 18x10 and 18x30 feet, in the corner of the fifth story of the New England Mutual Life building which fronts on Post Office Square. The offices have admirable light and a very agreeable outlook, and are in as desirable a location as Boston affords. The Secretary announces that he will be very glad to care for mail matter sent in care of the offices to members of the Association visiting Boston.

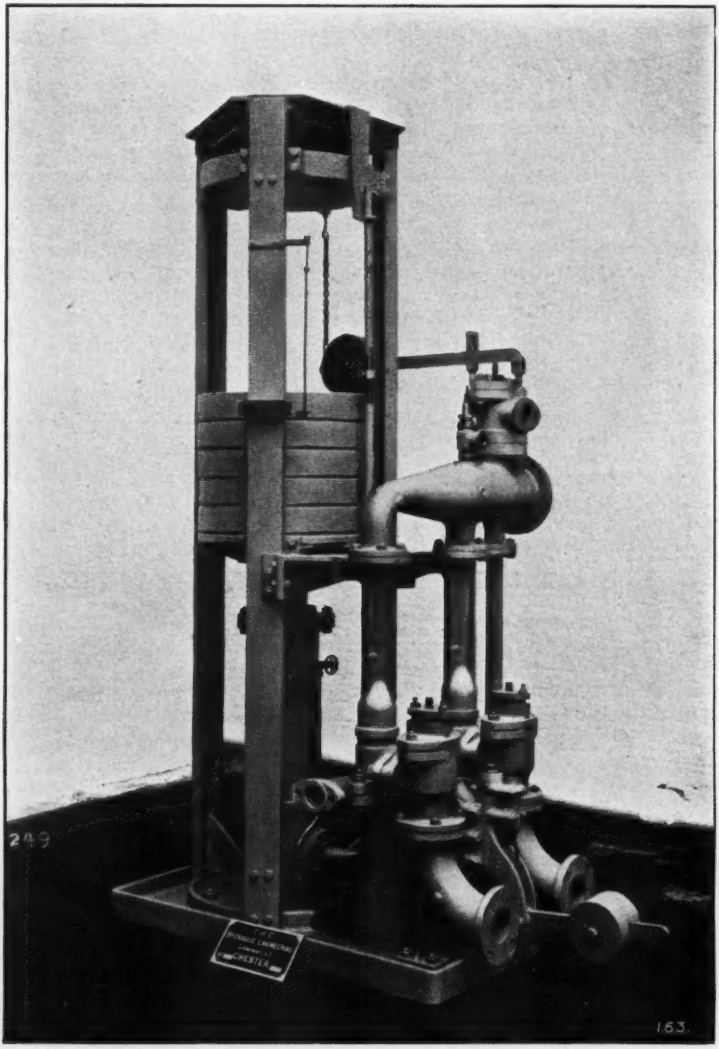
The London Hydraulic Power System.

By C. B. Mackinney.

Within a comparatively few years, several cities in the United States have installed high pressure water services to be used entirely or in part for fire service. All these systems are designed to furnish large volumes of water at high pressure.

In London they get the same result in a very different way. A private corporation has a system of mains in the streets which furnish the pressure, the volume being furnished by the regular city mains.

The London Hydraulic Power Company began operations in 1887. It now has about 160 miles of mains laid in the streets throughout the closely built up parts of the city on both sides of the river. It supplies hydraulic power for elevators ("lifts" they are called in London) and for general power purposes, and there are over 6,000 such connections to its mains. Turbines are extensively used in connection with this service, and are economically and successfully used for various purposes where continuously running machinery is required. The power is also used for running automatic pumping machinery and automatic ejectors for keeping the many basements, which are lower than the sewers, free from water. The system is in direct competition with electricity for power purposes and in a number of cases provides the water power to turn turbines directly connected with dynamos in isolated electric lighting plants.



Automatic device for furnishing high pressure supply to sprinkler system at any predetermined pressure regardless of number of sprinklers opening.
(London Hydraulic Power System.)

The water is taken from the Thames River, the Regents Canal and from wells, and is filtered before passing into the mains. There are four pumping stations. The water is pumped into accumulators loaded to a pressure of 750 pounds per square inch, producing the same effect as a reservoir at an elevation of 1,700 feet. The Company states that there is an average pressure of 700 pounds day and night all the year round. The street mains are mostly six-inch, there being some seven-inch in the more important centers. They are of extra heavy cast-iron pipe with thick flanges. The system is partly gridironed and liberally provided with valves so that in case of a break the section affected is made as small as possible.

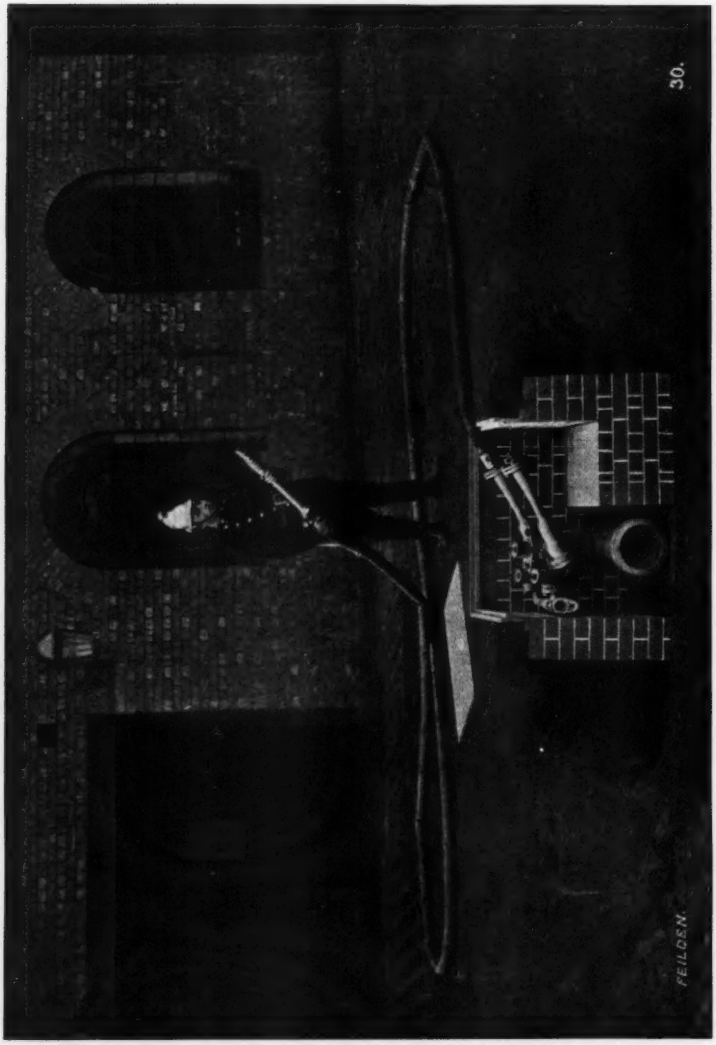
For fire protection purposes, this system is used in connection with the public water supply. Branches of both mains are brought into the plant to be served, and both connected to a device known as an Ellington injector. In this device, a small stream from the Power Company's main at very high velocity is directed into the system with a much larger volume of the sluggish city water.

To make the high pressure supply automatic and at the same time keep the very high pressure off the system, an automatic device is installed which will keep any desired pressure on the system, but when sprinklers operate will open the valves allowing full pressure. The device will also close the valves again if the flow of water is stopped.

The apparatus consists of one or more injectors which deliver into a discharge pipe leading to the sprinklers, which may at the same time be connected with the ordinary service mains; and an accumulator which controls the supply of high pressure water to the injectors. To ensure that the apparatus is always in working order a slight leakage is permitted from the discharge main, which causes the accumulator to fall slowly and in time opens the control valves and then again raises the accumulator. The whole operation repeats itself at fixed intervals. Should, however, the accumulator continue to rise owing to leakage past the valve, an additional load is lifted, and thus by increasing the pressure in the discharge main causes a relief valve to open. In case the relief valve should fail to act, the accumulator, on rising further, is made to open it mechanically.

In the event of a fire, when a sprinkler opens, there is a considerable draft on the discharge main, the accumulator then falls quickly, opens the valve fully, and allows a free passage of high pressure water to the injectors. If the flow through the injectors be greater than the discharge from the sprinklers or jets, the pressure in the discharge main is increased, the accumulator in consequence rises and partially cuts off the high pressure water supply, thus regulating the delivery through the injectors to the quantity required at the sprinklers. Should the discharge cease altogether the accumulator rises rapidly, closes the valve, and immediately resumes its slow up and down motion under the control of the automatic gear.

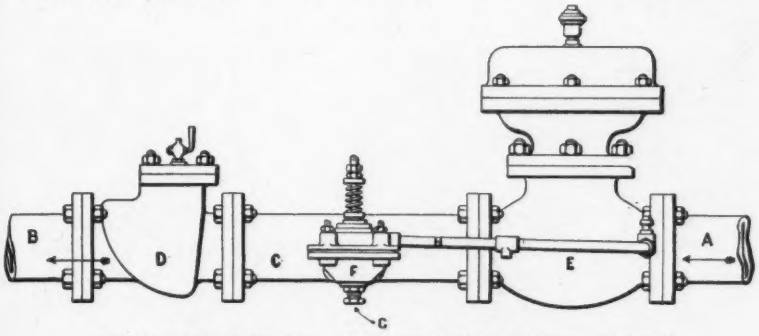
A special hydrant is used with this system having the large connection for the low pressure water, the small connection for the high pressure water and the ejector, and a controlling valve for each,



Double Hydrant with Injector and High and Low Service Connections.
(London Hydraulic Power System.)

all compactly arranged. It is simple, and as easily handled as an ordinary hydrant.

There is another very ingenious device installed to prevent the water from the Company's mains from flowing back into the city mains. It is called a "water lock" and consists of two peculiar check valves with an automatic relief valve which discharges to the atmosphere, if the pressure between the checks rises above the pressure in the town mains.



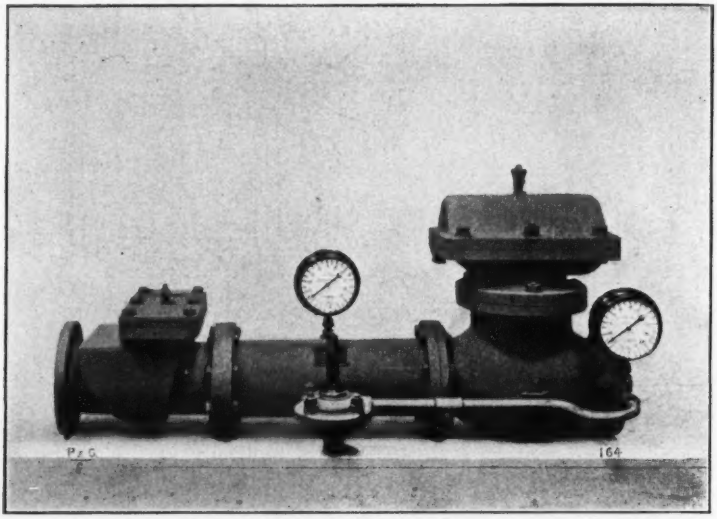
Water Lock; Drawing. (London Hydraulic Power System.)

The principle and action of the water locks are explained as follows with the aid of the lettered illustration to which reference is made:

A. Is the service pipe from the water mains.
B. The pipe leading to the injector hydrants, sprinklers or other apparatus to be worked.
C. Is the lock chamber.
D. An ordinary check valve allowing the flow of water in the direction of B. only.
E. Is a back pressure valve of special construction loaded by means of a spring so that a pressure of about three pounds per square inch is required to open it.
F. Is the automatic relief valve, the function of which is to allow water to escape from the lock when the pressure in the lock rises to within about three pounds of that in the water main, whatever that may be at the time.

The body of this valve is divided into two parts, an upper and a lower, by a metal diaphragm. The upper part is connected to the water main side of the valve E. by means of the pipe H., the lower part at the same time being in direct communication with the Lock C. A spindle passes through the centre of the diaphragm and is attached to it, the upper end of this spindle passes through a gland in the cover, the lower end terminates in the escape valve G. Attached to the upper end of the spindle is a spring tending to lift it and so open the escape valve G. and in order to close the valve G. the spring must be compressed. This will take place only when the pressure on the top

of the diaphragm which is exposed to the pressure from the main exceeds by about three pounds per square inch the pressure on the underside of the diaphragm, i. e., the pressure in the lock. It follows therefore that if the pressure in the lock rises to within three pounds per square inch of the pressure in the main the relief valve G. will open and by allowing water to escape to the atmosphere will reduce the pressure in the lock and the escape valve G. will be automatically closed again by the pressure from the main acting on the top of the diaphragm.



Water Lock; Outside View. (London Hydraulic Power System.)

It will be seen therefore that in the manner above described the water in the lock chamber is constantly maintained at a slightly lower pressure than exists at any time in the service pipe, and that it is impossible under these conditions for any leakage to pass back from the lock chamber into the service pipe.

An air snifting valve is provided on the top of the back pressure valve E. so that when the water from the mains is shut off and that valve closes the lock is automatically drained. A floating ball in the snifting valve provides for the admission of air when the lock is being drained and for the escape of air when the lock is being recharged and flotation automatically closes the air aperture when the lock is full.

The special feature about the spring back pressure valve E., which is of the mushroom type and closes upon a disc of leather, is that by a suitable arrangement of compensating levers contained within the valve chamber the resistance offered by the spring to the opening of

the valve does not increase the further the valve is opened, so the supply is not unduly throttled when a full flow is required.

A system of this sort could hardly be said to take the place of the high pressure water systems which have been installed in this country, and of course its use for fire service only, would hardly support such a service. This system, however, can be arranged to give a high pressure fire service which can be easily controlled and regulated as to pressures, for the reason that the pressure on any hydrant can be regulated varying the size of the orifices in the ejector. Two hydrants off the same main, at the same location, can be arranged to give two other different pressures by the same method.

It is stated that the system of the London Hydraulic Power Company is not unique, but we understand that the other installations are only small ones, in small towns in Great Britain.

Shoddy Mills---Their Processes and Hazards.*

By Dwight W. Sleeper,
Inspector Underwriters' Bureau of New England.

PROCESSES.

There was a time—longer ago than most people today can remember—when woolen cloth was woven from fresh, new wool and when the ultimate end of the rags was a rag carpet; today it would be possible to wear the same wool in several suits for, with our improved processes and utilization of all waste, woolen rags are too valuable and our tastes too highly cultivated to permit the profitable manufacturing of old-fashioned rag carpets. The result of these improvements has been the creation of a large and important business called "Shoddy," a term primarily applied to the woolen industry signifying old rags torn to pieces and rewoven into cheap woolen cloth but lately applied to anything not genuine. For some years shoddy wool was mixed in small quantities with new wool; nowadays new wool is mixed in small quantities with shoddy and, compared with much of the so-called woolen goods on the market today, an all-shoddy cloth may be considered high grade, for cotton is mixed to a large extent in the cheaper grades of woolen suitings.

Applying the term "shoddy" commercially—as is done in this article—there is another term which cannot well be separated from it for it is by one that the other is obtained; that term is "carbonizing." Shoddy is *wool* obtained by tearing rags to shreds or to fibres; if there be cotton or other substances mixed with the wool in the rags—and a pure wool cloth is rare—it must be removed and this accomplished by carbonizing or reducing to carbon. This process is based upon the fact that wool is

*Shoddy Mill Fire Record, Quarterly Vol. 2, No. 1 (July, 1908).

an animal product while cotton is vegetable. A process which will break up or reduce the vegetable fibre without injuring the animal accomplishes the desired results and this is what carbonizing does.

Raw Stock.

First let us consider the source of the raw material (as the rags may be called). When we find that the total amount of shoddy made in this country in 1904, according to the last government report, was 70,801,994 pounds and the total amount sold to the mills was 35,782,056 pounds, valued $4,833,949, we see how large the shoddy business is and since 1904 the trade has probably increased. Our old woolen clothes may be put to many uses about the house and some may be burned but the larger part finds its way into the hands of the rag picker. Few of us realize the extent of this branch of the wool industry. Every large city has a community where the rag pickers congregate and even the country towns and villages are able to boast of at least one member of this fraternity. The daily rag collection is carefully sorted over, the cotton rags being separated from the woolen ones and, when the quantity is sufficiently large, they are baled and shipped to the wholesale rag dealers. Again they are carefully sorted in these shops, the buttons, buckles, dirt, and so forth, partially removed and the rags separated according to the various grades. From these shops they are sent in bales to the various shoddy mills, of which there are a number in New England, and here the rags are treated and reduced to the wool fibre stage. There are strictly shoddy mills where the final process is carding the wool fibre and there are full-process woolen mills where shoddy carbonizing is but one department. In either class of mill the process of handling the shoddy is the same, except that to the writer's knowledge no full-process mill does dry carbonizing, while strictly shoddy mills may use either the dry or the wet process. The difference will be explained later.

Sorting.

The rags are bought in large quantities by the shoddy manufacturers and are stored in bales until needed. The first process is usually that of sorting. This is done by girls over tables having wire netting tops of large mesh to permit the dirt and buttons, and so forth, to fall through as removed from the cloth. All cotton pieces not previously removed and all pieces containing silk in any quantity are sorted out and discarded.

A large fortune awaits the discoverer of a process for removing silk from wool. It is not affected by carbonizing and its fibres are so fine and so tough that the cards cannot pick the threads apart and they break the woolen yarn; consequently any woolen pieces containing silk must be discarded as useless.

The acid used in carbonizing has different effects on different colors of cloth, so the rags are usually separated in a general way according to colors.

Dusting.

After being sorted, the rags are run through a duster or beater of the common type to remove the dust with which the rags are usually filled. They are then ready for treatment.

Wet Carbonizing.

There are two methods of carbonizing in use, viz.—wet and dry carbonizing. The wet process, although not quite so efficient, is the one

more generally used because it is the less expensive. The rags are placed in a wooden vat or tub containing cold water and commercial sulphuric acid of about 7° Twadell strength. They are left to soak for three-quarters of an hour, then removed and placed in a centrifugal drier where the excess moisture is extracted.

Baking. The rags are next placed in a baker where they are subjected to a temperature of from 200° to 250° F. for about half an hour. There are various forms of bakers, the type differing in nearly every factory. Primarily a baker consists of a wire screen upon which the stock is placed, with steam pipes underneath. In some factories "Stone" driers are used, in others the "Kitson" and "Sargent" types are found. The latter types consist of an iron box through which moves an endless wire apron; steam coils are placed in an offset box at one side and fans draw the air over the coils and drive it over the stock on the apron.

The baking increases the action of the acid upon the cotton with the result that, when finished, the cotton is reduced to powder and the woolen threads or fibres are ready to be separated at the slightest pull.

When dry, the rags are again dusted to remove the carbonized cotton and then washed in water containing alkali; this washing neutralizes the acid and prevents further action which would tend to destroy the wool fibre.

Drying. After being washed the rags are extracted in a centrifugal drier and run through a drier which may be similiar to the baker but in which the temperature is kept down to about 100° F.

Dry Carbonizing.

The so-called "dry process" of carbonizing is said to be superior in efficiency and less injurious to the woolen fibre but it is so much more expensive, because of the great amount of corrosion to the apparatus caused by the acid fumes, that it is not so generally used. The writer knows of but two "dry-process" plants in New England.

The apparatus consists of an iron box about 15 feet in each dimension within which is an iron cage made to revolve. At the side of the box and below it is a brick fireplace, the flue of which opens into the box. An iron pot 2½ feet in diameter is built into the fireplace and, through a hole in the top, hydrochloric acid is allowed to fall drop by drop. As the acid strikes the hot iron it is turned into gas and passes from the retort into the cage.

The rags to be treated are placed in the cage and the box closed. The cage is revolved for about twenty minutes in the hot air before the acid is applied; this drives off any moisture. The acid is then allowed to drip into the iron pot and the gas begins to act upon the rags. The temperature rises to about 200° F. and the chlorine, accelerated by the heat, acts rapidly. The rags are thus treated with acid and baked at the same time, the treatment being continued for from three to four hours.

After being carbonized the rags are dusted and then placed in an alkali solution for half an hour to neutralize the acid and, after being hydro-extracted, are dried in low temperature driers.

Picking and Carding.

The next process is that of picking the rags. The pickers used are of the ordinary type with all the attendant hazards of the wool picker for, although sorted a number of times, and the buttons and so forth removed,

there are bound to be some, particularly those sewed on with silk thread, which only the pickers remove. From the pickers the stock is either blown or carried to the cards and unless the mill is a full-process one, the stock is then baled for shipment.

General Features.

The foregoing account has treated particularly the carbonizing of rags but the process is by no means confined to the treatment of rags. New wool is full of burrs and other vegetable substances and is successfully treated for the removal of such matter by carbonizing. The stock is first dusted and then run through a burr picker; this removes the burrs but does not get at the husks and other fine particles. The stock is then treated as described under the "wet process." In some mills making a high grade of wool goods the cloth before being finished is treated in a weaker acid—about 5° Twadell—and baked in a high temperature cloth drier to remove the dust or any vegetable matter that may have collected in the course of manufacture.

It may be said that England is the great shoddy centre of the world, rags being imported there from all countries. Of late years the demand for shoddy in this country has decreased because of the tariff on the importation of wool. Also the public taste has turned from woolens to worsteds; and shoddy, being a short fibre stock, is of little use for this class of goods.

Shoddy is used in great quantities in the manufacture of horse blankets and felt boots as well as for clothing.

HAZARDS.

Storage.

There seems to be little danger attending the storage of rags or carded stock. Before reaching a mill the stock is picked over and sorted quite thoroughly, there is little chance of much of it being oily enough to cause spontaneous combustion and the experience of steamship companies has been such that most of them do not hesitate to store bales of rags in the holds of their ships. It is always best, however, with all kinds of stock to store it in detached or cut-off storehouses which should be cut up into fire sections consistent with quantity and value of the stock.

Sorting and Dusting.

The space under and around the sorting tables should be kept clean and the dusters should always be arranged to discharge out of doors, as the dust may form an explosive mixture if confined. Bearings should also be properly cared for and kept clean.

Carbonizing.

There is no hazard about the treating of the rags by wet process method during the early stages but the bakers offer the most serious hazard in shoddy mills. The woodwork used in many of the various types of bakers becomes tinder dry under the excessive temperature of 200° to 250° and fire is communicated with great rapidity throughout. The sides of the baker should be arranged so as to make the inside easy of access for cleaning and inspectors should insist that this be systematically and thoroughly done.

If the baker be of the "movable apron" type the fan and apron bearings should be outside of the box and easy to get at. Most fires in this

type of baker are started just before closing down for the night and it is believed that if it were easier to get at the bearings to clean and oil them the men would not be so prone to neglect or wait until after shutting down before undertaking this important task. It is desirable to locate bakers in a section cut off by a standard fire wall and preferably of fire resisting construction.

In the "dry-process" method the hazard lies in the fact that there is a fire within the building, but if the fire box is properly built with the floor in the immediate vicinity made of dirt or cement—and such is the case in each mill that has come under the writer's inspection—the danger from this source is slight and probably no greater than with the baker used in the wet process.

This process should be and usually is conducted—particularly where the "dry" method is used—in a separate or remote part of the plant.

Picking.

Probably more fires occur in the pickers than elsewhere and no well constructed mill contains them inside the main plant. The danger is so well known that fires are carefully guarded against and seldom get beyond control. The most valuable asset in protection of this department is a handy chemical extinguisher. This hazard is too well understood to require any further description here.

Cleanliness.

Because of the dirty stock used, the dirt caused by carbonization and the great amount of corrosion caused by the acid, the tendency is to neglect cleanliness and care. It is, therefore, vitally necessary that inspectors enforce cleanliness and proper supervision of all fire appliances in these risks.

PROTECTION.

Shoddy mills like most other classes of manufacturing risks are frequently equipped with automatic sprinklers. This form of protection is always efficient when properly installed and cared for but in shoddy mills more than ordinary care is necessary. This is due to the fact that corrosion of pipes and sprinklers is unusually severe owing to the presence of so much acid. If all piping is kept thoroughly painted with some good paint made for this purpose and all sprinklers coated with an approved wax coating, this trouble should be reduced to a minimum. Even then it is necessary to replace the sprinklers occasionally. This is one of the most important points in a shoddy mill for an inspector to carefully follow up.

It is almost impossible to keep sprinkler heads inside of bakers in satisfactory condition as the temperature is too high to use any wax coating and there seems to be nothing else that is reliable and that will withstand high temperatures. Probably the best solution for this trouble is to locate the bakers in rooms of fire resisting construction and make the bakers themselves as nearly fireproof as possible.

Other forms of fire protection, such as pails, standpipes, hydrants, and so forth, do not differ in shoddy mills from what is used in other risks.

With good management and proper means for protection there seems to be no reason why this class of risk should be viewed unfavorably.

Auxiliary Squad A Springfield, Mass., Fire Department.
Put into service September, 1906.

40 H. P., air cooled, 4-cylinder, 4-cycle motor; 34x5" Fisk pneumatic tires. Carries assistant chief and eight men. Equipment, two 3-gallon extinguishers, play pipes, two fire department lanterns, two axes, door opener, claw bar, life belts, life gun, and rope. Weight with men as driven to fires, 5,050 pounds.

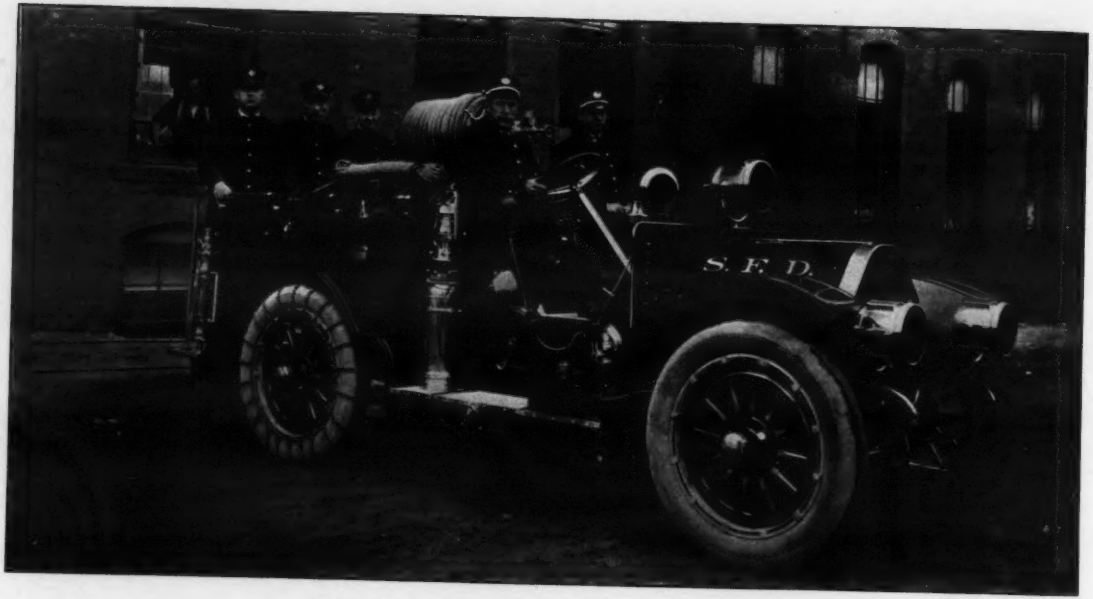
The Auxiliary Squad.

A New Idea in Fire Fighting in Connection with the Automobile.

Eight or nine years ago the Holyoke, Mass., fire department had a brilliant idea. It fixed up a wagon with a three-horse hitch for the purpose of transporting eight or ten firemen on the jump to the point where they were needed most, thus reinforcing the companies in whose bailiwick there was need of fire fighting. This hurry-up wagon with its quota of men was called the auxiliary squad, and it was the forerunner of the up-to-date automobile flying squadron of today. So far as anybody knows, Holyoke was the pioneer. The idea, borrowed from no other city, was first-rate military tactics in the battle against fire, and is now being followed out with notable success, particularly in Springfield, Mass.

When Springfield saw the value of the auxiliary squad it adopted the idea and went Holyoke one better by doing the rapid transportation work by motor instead of horse-power. The department had had uncomfortable experiences. Its companies scattered over the city had too few men to tackle a fire effectively at its start. In one case the captain of a company was found struggling alone with a hose pipe that he could not manage. The driver of the hose wagon went to his assistance and his team ran away. To make each of the companies large enough to be independent would have cost the city a lot of money. Hence the value of a rapidly moving central reinforcing squad that would get to the fire about as soon as the company whose particular business it was.

The first automobile, Squad A, went into commission in September, 1906. It carries eight firemen, two fire extinguishers and a number of implements, such as axes, door opener, ropes, a life gun, nozzles and, sometimes, hose. It proved to be so efficient that in March, 1907, Squad B went into commission. This is practically the same as Squad A but it carries four extinguishers instead of two. These machines are both 40 horse-power. In April of that year came the two automobiles for the chief and deputy, each of about 25 horse-power and all the speed that anybody dare use. The fifth of the fire automobiles began its service in August of last year. This is the combination hose and chemical. Its motor is rated at 40 horse-power as it carries 1,000 feet of 2½-inch water hose, a 35-gallon chemical tank with 200 feet of ¾-inch chemical hose on a reel, one small extinguisher and a variety of fire tools, including axes, door openers, crossbars, sledge-hammers,



Hose No. 7 Springfield, Mass., Fire Department.

Put into service August, 1908.

40 H. P., air cooled, 4-cylinder, 4-cycle motor; 40x6" Fisk pneumatic bolted-on tires, removable rims. Equipment, 1,000 feet 2½" hose, one 35-gallon chemical tank and reel, 200 feet ¾" chemical hose, one 3-gallon extinguisher, and all necessary fire tools. Weight with five men as driven to fires, 7,000 pounds.

cellar pipe, siamese connections, revolving nozzles, hydrant valves and rope.

Altogether the five fire automobiles make a brave showing as well as an exceedingly effective fire-fighting combination. They are not only cheaper than horses but are much more efficient. Just what the automobiles will cost in the long run is not yet known. This fact is interesting, however: During the first six months of its service the combination hose and chemical answered 71 fire alarms, and its cost during this period, including fuel, lubricating oil and repairs, was $4.79. The machine is as good as new and apparently the second six months will cost no more than the first. Roughly speaking the first cost of an automobile combination is $5,000; that of horse-drawn apparatus, of the same sort including horses, harnesses, wagon and supply wagon, $2,500. That is, the automobile costs twice as much, but it is reckoned that the cost of maintaining an automobile is so much smaller as to make up the difference in about three years, not to mention an efficiency on the part of the automobile somewhere between 50 and 100 per cent. greater than that of horse-drawn apparatus. The keep of a horse costs about $250 a year, not counting repairs to buildings and a lot of odds and ends that amount to a good deal in the aggregate. Also, automobiles can be housed much more economically than horses, requiring smaller buildings and less land. A pair of good fire horses costs about $650 and as the service of a fire horse is reckoned as about five years, the depreciation of a pair can be put at about $130 a year. If the depreciation and repairs of an automobile should be no more than that, practically the entire expense of keeping horses, less the trifling cost of fuel and oil, would be saved.

The ability of the automobiles to reach the fire in advance of the horse-drawn apparatus is the greatest thing in their favor. The economy is not inconsiderable however, for it must be reckoned that, if the motor apparatus has an efficiency of 50 per cent. greater than that of the horse-drawn apparatus, it will be possible to maintain fewer pieces and thus to effect a saving.

The demand is growing for automobile fire engines in which the power for pumping is derived from the motor of the automobile. The large fire apparatus supply houses throughout the country are now putting out apparatus of this order. One concern has now on the market an automobile fire engine of this type which is in use in several cities, including New Haven, Conn., and Brockton, Mass. Satisfactory performances are reported. The automobile fire engines are of 40 horsepower. When the machine arrives at the fire the motor is set at work running the pump.

It is maintained that the power derived from the 40 horse-power motor will not pump water so efficiently as the present steam engines under good conditions. The automobile engines are guaranteed to pump 600 gallons of water a minute through open butts. When two lines of hose of 400 feet length each are attached to the engine, the amount of water that can be pumped is lessened considerably. The steam fire engines in Springfield will each pump 600 gallons of water a minute through two lines of hose 400 feet long. With automobile

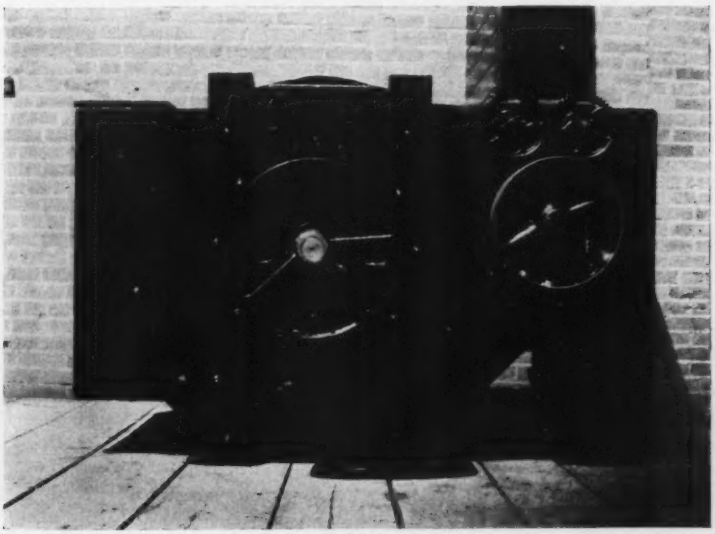
fire engines of larger horse-power stronger pumping might, however, be maintained. Most of the automobile fire engines have thus far been equipped with rotary pumps, and that style of pump is not considered so satisfactory for fire purposes as the piston pump. It is asserted that when the power of the gasolene engine of the automobile fire engine can be diverted to operate the piston pump successfully no city will be able to afford to maintain steam fire engines.

The attractive features of the automobile fire engine are even more noticeable than in other sorts of motor-driven fire apparatus. It takes a three-horse hitch to haul the large steam fire apparatus. The cost of keeping the team runs over $700 a year. The steam fire engine requires a driver, a stoker and an engineer, while with the automobile apparatus the driver could be the stoker and the engineer himself. The steam fire engine is delicate, and requires constant and careful attention during operation, in order that sufficient steam may be kept up for efficient running. When the automobile engine arrives at a fire, its engine can be immediately set at work pumping water, and its pumping is bound to be steady. The steam engine also requires the attendance of a team for supplying fuel during a big fire, while the automobile engine could easily carry enough fuel for continuous operation for over 24 hours.

Boll Breakers---A New Hazard in Cotton Gin Houses.

By R. D. Coughanour, Jr.

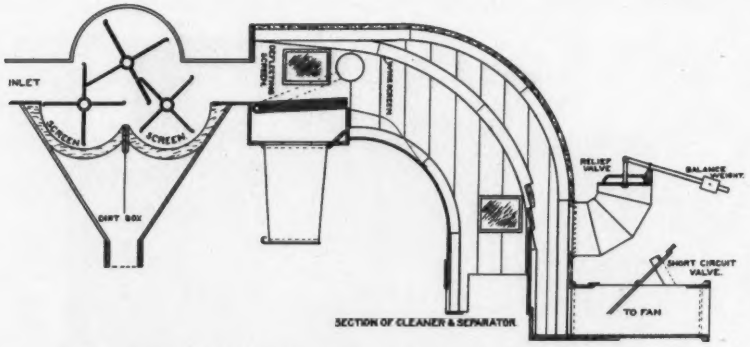
Just as years ago the cotton ginners threw away their cotton seed, because of the indifference of the farmers to its value as a fertilizer and cow food, and because no other use had been found for it, so, until a few years ago, what is known as "boli cotton" was left in the fields to rot. "Boli cotton" is the cotton bolls which, by reason of a severe drought or lateness of the season, may fail to open, but in which the cotton fibre is developed. Some five or six years ago an enterprising owner of a wheat threshing outfit, whose threshing machine was idle during one of the seasons when the farmers were bewailing the fact that their cotton crop was a failure because of the bolls failing to open, conceived the idea of crushing the bolls by running them through his threshing machine, and thus enable the gins to handle this cotton,



Boll breaker; Outside View.

which would otherwise go to waste. The plan then was to place the thresher some 40 or 50 feet away from the gin, run the thresher with an ordinary traction engine, and deliver the crushed bolls on the ground at the suction elevator of the gin. The only fire hazard considered in connection with this process at the time was the danger of sparks from the smokestack of the stationary engine. Later on, however, it developed that this "boli cotton" was full of sand and dirt, and would practically wear out the average gin stand in one season; again, numerous small fires were reported by reason of rocks and nails being carried in with the dirty cotton, though the writer does not recall any serious fires originating from this particular cause.

Eventually, from this crude method of threshing out the unopened bolls, has come the present boll breaker, which is now, where desired, made a part of the regular equipment of the gin. So far as the writer has been able to ascertain, there are now thirty-four types of boll breakers on the market. Thirty-two of these demand especial consideration, because of their being placed in a direct line with the suction elevator. In the remaining two of the thirty-four, one of which has greater merit than the other, and both having more merit than all the others combined, the cotton, after passing through the boll breaker, is first delivered on the ground, and must then be taken up by the suction elevator. All but one of the boll breakers examined crush the bolls by means of knives, revolving in opposite directions at a speed of from 600 to 900 revolutions per minute. In case of these knives becoming bent



Section of Boll breaker showing revolving knives which may cause fire by striking as cotton passes through.

by reason of obstructions, such as rocks, pieces of steel, and so forth, delivered with the cotton, or in case of any of these articles striking the knives while running at this rate of speed, fire must inevitably result; and where the breaker is in a direct line with the suction elevator, this fire may of course be immediately carried into the gin stands. There is one favorable aspect to all these boll breakers, which is that to a considerable extent they act as cotton cleaners, and sift out the sand,

nails, and so forth, which would otherwise be carried into the gin stands. To this extent they lessen one of the serious common hazards in all cotton gin plants where they are in use. The use of boll breakers must be considered a serious increase of hazard where they are placed either in the main building or immediately adjoining, and where the cotton is delivered direct from the boll breaker through the suction elevator to the stands.

A careful consideration of the subject should lead an intelligent owner to conclude that the bolls should be crushed in a separate building, not less than 40 feet from the gin building, and under no circumstances should the crushed bolls be delivered direct to the gin stands; or, in lieu thereof, the cotton should be delivered either onto the ground or into a small shed room erected for the purpose, and from there taken up by the suction elevator and carried into the gins.

There is reported to be another hazard found in connection with the plants operating boll breakers, as a result of the tendency on the part of owners to use the hulls of crushed bolls for fuel. In order to use these hulls for fuel it frequently becomes necessary to burn them in connection with crude oil. It is reported that this combination fuel creates a sooty deposit on the inside of the smokestack, which every few weeks catches fire and burns from ten to twenty feet above the top of the stack, throwing out sparks which are likely to set fire to the gin itself, and to the seed cotton which is so frequently piled up on the outside of gins during the busy season, when the regular seed houses are already filled to overflowing. One case is reported in which there is no question but that some $5,000 worth of seed cotton was destroyed from this cause; and a prominent gin man has stated to the writer that on several occasions he has seen wagons filled with seed cotton, waiting their turn at the gin, set fire from the stacks of furnaces using this fuel.

The ginning of "boli cotton" has come to stay, and no doubt such safeguards will eventually be thrown around the process as will make it reasonably safe; but meanwhile the operation of boll breakers must be considered a serious increase of hazard, and where installed careful attention should be given to the mechanical means employed and to the location of the machinery.

Barium Dioxide.

(Barium Peroxide Ba O_2).

Note.—Fire No. 8059, page 497, Quarterly Vol. 2, No. 4 (April, 1909), was caused by the ignition of a drum or container of barium dioxide due to boring into the same to obtain sample. This method of sampling had been a common one for many years without similar mishap. Through the courtesy of Mr. A. H. Nuckolls, Chemical Engineer of the Underwriters' Laboratories, we give below the result of tests upon this compound, together with a description of its nature and character.—Editor.

Experiments with this material indicate that the peroxide of barium may be safely heated to a bright red heat without combustion or violent decomposition taking place, provided the peroxide is not in contact with organic matter or inflammable gases, vapors or certain chemicals such as magnesium. However, when this compound is heated in contact with organic matter (paper, vegetable fibres, wood, fats, oils) a more or less violent combustion occurs. For example, if barium dioxide is placed on a board or in a wooden container and ignited active combustion accompanied by the evolution of a great deal of heat takes place, and if the burning materials are confined an explosion results.

It appears that a mixture of organic matter and barium peroxide may be easily ignited by a small flame, red-hot wire, spark, or heating to a temperature near a red heat.

If the wooden cask which was destroyed at the Minneapolis fire contained barium peroxide and it is assumed that the material was ignited by heat caused by friction, a spark or flame, the combustion of the cask is easily accounted for.

If the chemist in the process of boring into the cask introduced wood sawdust or some other organic matter a mixture could easily have been formed which would, as stated above, ignite very easily.

We have no facts before us in regard to the properties of barium peroxide and the reported events as to the fire which indicate the likelihood of spontaneous ignition having occurred in this case.

We state below in more detail the properties of barium peroxide:

The barium peroxide generally found on the market is a heavy greyish powder, containing silica, lime and ferric oxide. When pure and dry it is a white powder. It is used in the manufacture of Hydrogen Peroxide. It is formed when the oxide of barium (Ba O) (analogous to the oxide of calcium—Ca O—quicklime) is heated at a low red heat in air free from carbon dioxide. It fuses at a bright red heat, giving up oxygen and forming the monoxide (Ba O). The temperature of decomposition of the peroxide is stated to be 800° C. (1472° F.) to 1000° C. (1832° F.) according to conditions. It reacts with dilute mineral acids (sulphuric, hydrochloric) with the formation of hydrogen peroxide (explosive) and a salt of barium corresponding to the acid. Concentrated sulphuric acid reacts with the dioxide, forming what is termed ozonised oxygen (oxygen in a very active state, chemically speaking) and barium sulphate. With water barium dioxide forms the hydrate (Ba O_2 $8H_2$ O).

It does not, however, react violently with water as does the monoxide of barium and the oxide of calcium. If heated in the presence of sulphur dioxide it becomes incandescent. When heated in contact with organic matter (paper, fabrics, leather, wood, grain, fats, oils) or inflammable vapors or gases there is more or less violent reaction according to the conditions. The combustion liberates a great deal of heat. It does not ignite when on glass or porcelain if, as stated above, it is free from inflammable matter.

Barium dioxide is a carrier of oxygen, containing a portion of its oxygen in a loosely combined state; hence, it will behave to a large extent like oxygen itself and has, broadly speaking, the same dangerous properties. From the fire insurance viewpoint it should, we think, be classed with the important carriers of oxygen such as potassium chlorate, potassium and sodium nitrates, sodium peroxide. In this connection, however, it should be noted that the barium peroxide is not as hazardous in all respects as potassium chlorate and sodium peroxide, a difference being that the chlorate of potassium may liberate its oxygen in an explosive manner when heated, while the peroxide of barium when free from organic matter liberates oxygen quietly when heated. Sodium peroxide is liable to cause spontaneous ignition when in contact with organic matter, while barium dioxide does not under ordinary conditions exhibit this dangerous property.

Report of Secretary.

LIST OF MEMBERS ELECTED BY THE EXECUTIVE COMMITTEE SINCE FEBRUARY, 1909.

MARCH, 1909.

ASSOCIATE.

Mr. Geo. M. Chamberlin, Inspector, Underwriters' Bureau of New England, 93 Water Street, Boston, Mass.

Mr. Edward W. Dart, Inspector, New York Fire Insurance Exchange, Room 721, 32 Nassau Street, New York, N. Y.

Mr. Alexander Field, Johnson & Higgins, 244 California Street, San Francisco, Cal.

Mr. Joseph A. Geyer, Special Agent, American Insurance Company of Newark, N. J., P. O. Box 506, Syracuse, N. Y.

Mr. Nelson P. Weier, Engineer and Inspector, Fire Protection Department, Metropolitan Street Railway Company, 159 W. 22nd Street, New York, N. Y. (A member of the A. I. E. E.)

SUBSCRIBING.

Industriidkarenes I Finland Omsesidiga Brandforsakringsbolag, Helsingfors, Finland, Europe.

Mr. E. F. Rosenow, Chief Engineer, The Brown Shoe Company, St. Louis, Mo.

Wm. Steele & Sons Co., Building Construction, 1600 Arch Street, Philadelphia, Pa.

Mr. John Tilley, Mechanical Engineer, Whitney-Steen Company, 135 Broadway, New York, N. Y.

APRIL, 1909.

ASSOCIATE.

Mr. Edwin Lee Ballard, with Underwriters' Bureau of the Middle and Southern States, 72 William Street, New York.

Mr. John L. Brown of Brown & Hopson, Fire Insurance Agents, 5 Bread Street, Utica, N. Y.
Mr. Robert K. Grems, President Robt. K. Grems & Company (Inc.), Box 258, Vernon, N. Y.
Mr. Louis Wiederhold, Jr., Secretary, The Underwriters' Association of the Middle Department, 316 Walnut Street, Philadelphia, Pa.
Mr. Fremont Wilson, Electrical Engineer, 34 Pine Street, New York, N. Y.
Mr. Robert S. Woodward, 2 Wall Street, New York, N. Y.

SUBSCRIBING.

Mr. J. S. Calvert, Assistant Superintendent, Western Union Telegraph Company, Atlanta, Ga.
Mr. W. W. Carman, Main Sprinkler Company, 78 Union Street, Portland, Me.
General Library, National Electric Lamp Association, 4503 Hough Avenue, Cleveland, O.
Mr. Nathan Hayward, Chief Engineer, Bell Telephone Company of Pennsylvania, 11th and Filbert Streets, Philadelphia, Pa.
Mr. J. J. Thomas, Manager Insurance Engineering Department, The American Appraisal Company, Milwaukee, Wis.

MAY, 1909.

ASSOCIATE.

Mr. J. F. Barley, Special Agent, Phenix Insurance Company, 93 Water Street, Boston, Mass.
Mr. Chas. G. Bates, State Agent, American Central Insurance Company, 718 Phoenix Building, Minneapolis, Minn.
Mr. Royal S. Cleaves, Superintendent Sprinklered Risk Department, Royal Exchange Assurance Company, 92 William Street, New York.
Mr. Harry C. Dent, care of Wallace Reid, 56 Maiden Lane, New York.
Mr. Bernard Faymonville, Vice-President, Fireman's Fund Insurance Company, 401 California Street, San Francisco, Cal.
Mr. W. E. Fudger, General Agent, St. Paul Fire and Marine Insurance Company, 88 King Street, East Toronto, Ont.
Mr. J. Barbour Gray, Special Agent, Citizens Insurance Company of Missouri, 312 Columbia Building, Louisville, Ky.
Mr. J. M. Haydock, 84 William Street, New York, N. Y.
Mr. T. F. Holland, Inspector, Underwriters' Bureau of New England, 93 Water Street, Boston, Mass.
Mr. A. R. Hosford, Assistant Manager, Royal Insurance Company, 84 William Street, New York, N. Y.
Mr. Chas. A. Markham, Inspector, New York Board of Fire Underwriters, Room 710, 32 Nassau Street, New York, N. Y.
Mr. E. A. Morrell, J. G. Hilliard Agency, 41-3 Pine Street, New York, N. Y.
Mr. Richard A. Munroe, Insurance Broker, 64 Wall Street, New York.
Mr. F. H. Warren, Manager, Tennessee Inspection Bureau, 1506 Tennessee Trust Building, Memphis, Tenn.
Mr. Raymond Willis, Willis, Faber & Co., Ltd., 28 Board of Trade, Montreal, Can.

SUBSCRIBING.

Mr. Frederick J. G. Knowlton, B. C. L., Barrister-at-Law, St. John, N. B.
Mr. J. C. Specht, Vice-President, California Cornice Works, 1610-1614 San Fernando Street, Los Angeles, Cal.
The Usona Manufacturing Company, Aurora, Ill.
E. Van Noorden Company, 944 Massachusetts Avenue, Boston, Mass.

JUNE, 1909.

ASSOCIATE.

Mr. H. B. Anderson, Surveyor, Inspection Department, New York Board of Fire Underwriters, 34 Nassau Street, New York, N. Y.
Mr. C. D. Beardsley, Branch Manager, Tennessee Inspection Bureau, 808 Knoxville Banking and Trust Building, Knoxville, Tenn.

Mr. Lewis R. Bird, Inspector, New York Board of Fire Underwriters, 817 Richmond Street, Plainfield, N. J.
Mr. Roger Wake Clark, Insurance Surveyor, Hartford Fire Insurance Company, 75 William Street, New York, N. Y.
Mr. G. B. Douglass, Inspector, Survey Department, New York Board of Fire Underwriters, 165 Summit Avenue, Upper Montclair, N. J.
Mr. Alf. B. Dufresne, Manager, Montreal-Canada Fire Insurance Company, P. O. Box 313, Montreal, Can.
Mr. J. C. Evans, Inspector, Texas Fire Prevention Association, 144½ Laclede Avenue, Dallas, Tex.
Mr. Paul Jacobi, Assistant Manager, Prussian National Insurance Company of Stettin, Germany, Stettin, Germany.
Mr. Hal Moseley, Inspector, Texas Fire Prevention Association, 821 Wilson Building, Dallas, Tex.
Mr. J. M. Stoney, Jr., Caledonian Insurance Co., 50 Pine Street, New York, N. Y.
Mr. W. C. Sweetman, Branch Manager, Tennessee Inspection Bureau, 919 James Building, Chattanooga, Tenn.
Mr. P. P. Tucker, Special Agent, Aetna Insurance Company, 630-31 Wilson Building, Dallas, Tex.

SUBSCRIBING.

Mr. J. Henry Miller, Contracting Builder, 106 Dover Street, Baltimore, Md.
Mr. Herman W. Nelson, Automatic Sprinkler Contractor, Moline, Ill.
Mr. W. J. Pollard, Inspector, International Harvester Company, Auburn, N. Y.
Mr. Herbert F. Stimpson, Industrial Engineer, 1134 Pacific Street, Brooklyn, N. Y.
Southwestern Supply Company, Inc., Fort Worth, Tex.

Committee Reports.

MEETING OF THE EXECUTIVE COMMITTEE.

H. L. Phillips, Chairman,
5 Haynes Street, Hartford, Conn.

A meeting of the Executive Committee was held in New York, at Cafe Lafayette, Monday evening, May 24, 1909, the following members being present:

Mr. H. L. Phillips, Chairman, Hartford; Mr. Albert Blauvelt; Mr. G. E. Bruen, New York (representing Mr. Miller); Mr. G. W. Cleveland, Cincinnati; Mr. T. Z. Franklin, Philadelphia (representing Mr. Creighton); Mr. W. J. Fredrick, Buffalo; Mr. C. A. Hague, New York; Mr. H. E. Hess, New York; Mr. C. A. Hexamer, Philadelphia; Mr. F. E. MacKnight, Atlanta; Mr. C. H. Phinney, Boston; Mr. M. D. Pierce, New Orleans; Mr. W. G. Sanderson, Chicago; Mr. W. H. Merrill, Secretary, Chicago; Mr. C. M. Goddard, President, Boston; Mr. H. C. Henley, Vice-President, St. Louis. There were also present by invitation: Mr. H. A. Fiske, Hartford, Editor of the QUARTERLY; Mr. W. C. Robinson, Chicago, Chairman Committee on Devices and Materials; Mr. E. W. Beardsley, Hartford, President National Association of Local Fire Insurance Agents; Mr. F. M. Griswold, New York, Chairman Committee on Standard Hose Couplings for Hydrant Fittings for Public Fire Service; Mr. William A. Anderson, New York; Mr. Everett U. Crosby, Philadelphia; Mr. Thomas Boardman, Hartford.

The President's report on the publicity work for the portion of the year following its inauguration was read and warmly adopted with the recommendation that continuance and expansion of the work be recommended to the incoming Executive Committee and that this work be called to the attention of all members, active, associate and subscribing.

President C. M. Goddard was appointed a committee of one to confer with officers of the National State Fire Marshals' Association in matter of publicity work and co-operation therein.

The resignation of Mr. E. B. Creighton as a member of the Executive Committee, made necessary by his change in business, was accepted with regret.

The President was authorized to sign lease for the offices of the Association at 87 Milk Street, Boston.

A special meeting of the Executive Committee was held in rooms of New York Board of Fire Underwriters, at noon, Thursday, May 27, 1909. Present:

Mr. H. L. Phillips, Chairman; Mr. Albert Blauvelt; Mr. G. E. Bruen, representing Mr. Miller; Mr. T. Z. Franklin, representing Mr. Creighton; Mr. W. J. Fredrick; Mr. C. A. Hague; Mr. C. A. Hexamer; Mr. F. E. MacKnight; Mr. M. D. Pierce; Mr. W. G. Sanderson; President C. M. Goddard.

The meeting was called for consideration of report of the Committee on Pipe referred to the Executive Committee at meeting of the Association, May 26. After discussion, the following resolution was adopted as a report back to the meeting which was still in session:

RESOLVED: That the specifications and standards of the American Water Works Association for cast-iron water pipe be adopted by this Association with the understanding that in dealing with special high pressure systems for fire protection purposes supplied by separate pumping stations, individual treatment may be needed.

Franklin H. Wentworth, *Secretary.*

COMMITTEE ON DEVICES AND MATERIALS.

W. C. Robinson, Chairman,
382 Ohio Street, Chicago.

The regular quarterly meeting of this Committee was held at the Executive Committee Room of the National Board of Fire Underwriters, 135 William Street, New York, on Monday, May 24, 1909, beginning at 10 a. m. The following members were in attendance:

Mr. W. C. Robinson, Chairman, Chicago; Mr. W. H. Merrill, Chicago; Mr. W. G. Sanderson, Chicago; Mr. W. D. Matthews, Chicago; Mr. W. A. Anderson, New York; Mr. E. P. Boone, New

York; Mr. F. J. T. Stewart, New York; Mr. F. J. McFadden, New York; Mr. E. T. Cairns, New York; Mr. R. H. Newbern, Philadelphia; Mr. E. U. Crosby, Philadelphia; Mr. John H. Kenney (representing Mr. C. A. Hexamer), Philadelphia; Mr. T. Z. Franklin, Philadelphia; Mr. F. E. Cabot, Boston; Mr. H. O. Lacount, Boston; Mr. E. A. Northey, Boston; Mr. Ralph Sweetland, Boston; Mr. H. L. Phillips, Hartford, Conn.; Mr. John M. Hughes, Newark, N. J.; Mr. F. W. Jenness, Syracuse, N. Y.; Mr. H. C. Henley, St. Louis, Mo.; Mr. M. D. Pierce, New Orleans, La.; Mr. J. R. Sullivan, Milwaukee, Wis.; Mr. F. C. Moore, Hartford, Conn.; Mr. F. E. MacKnight, Atlanta, Ga.; Mr. J. C. Richters, New York, N. Y.

There were also present by invitation:

Mr. C. M. Goddard, President National Fire Protection Association; Mr. C. R. Alling, Assistant Engineer Underwriters' Laboratories; Mr. Thomas Boardman, Engineer Factory Insurance Association.

The annual report of the Committee was drawn up and presented to the Association at the annual meeting the following day. Full text of this report appears in the Proceedings. The usual routine matters were covered, and action taken on Laboratory reports covering a number of individual devices and materials.

A proposed tentative standard for chemical extinguishers was discussed at length, and it was voted to include capacities as follows:

3-gallon, 25-gallon, 40-gallon, 60-gallon, 80-gallon, double 40-gallon, 100-gallon, 250-gallon, 500-gallon.

Some slight amendments were adopted covering the specifications of the 3-gallon and 40-gallon sizes, and the specifications for other than the 3 and 40-gallon sizes were referred to a Special Committee to work with the Laboratories and report at a future meeting.

A tentative standard was endorsed covering proposed exhaustive series of tests having in view a classification of roofing coverings.

The action of the Committee covering a large number of individual reports has been announced through the Laboratory cards and the published lists.

W. C. Robinson, *Chairman.*

Approved Devices and Materials.

There are listed below in form convenient for reference by members the names and addresses of manufacturers of devices and materials which have thus far been favorably passed upon by the Devices and Materials Committee, following examinations, tests and recommendations made by Underwriters' Laboratories, Inc.

The Laboratories have also issued reports giving ratings unfavorable to a large number of appliances. A summary of the findings in each case can be obtained by addressing the Laboratories and any Active or Associate member can receive regularly the cards issued by the Laboratories giving summaries of the results obtained in the current work in all of its departments upon payment of the subscription price of fifteen dollars ($15) per year.

In the lists which follow members should note particularly that in those industries to which the label service has been extended (indicating inspection of goods by Laboratories' engineers at factories before shipment) **only such of the product of these factories as bear the labels referred to** are covered by the endorsement of the Committee.

BUILDING MATERIAL.

Post Cap and Girder Support (Steel and Malleable Iron).

Caps inspected at factory bear labels attached to an exposed side reading as follows:

The following companies are equipped to supply these devices:

Chicago, A. M. Castle & Co., 55 N. Jefferson Street.
Cleveland, The Duplex Hanger Co.

Asbestos Building Lumber.

Asbestos Lumber manufactured by the following company is considered from the insurance viewpoint as superior to wood for the uses intended.

Ambler, Pa., Keasbey & Mattison.

Sagax Wood.

Made of ground straw, a cement binder and a few other ingredients, the exact composition being regarded as a trade secret.

Laboratory tests indicate that this material is non-combustible, a good non-conductor of heat, and when made in large sections of sufficient thickness is only slightly injured by high temperatures and the subsequent application of water. It absorbs moisture slowly, is considerably heavier and more brittle than wood and can be worked with ordinary woodworking tools.

The following company manufactures this material:

Baltimore, Md., Sagax Wood Co.

CARBONIC ACID GAS HAND FIRE EXTINGUISHERS, 3 Gallons.

Carbonic Acid Gas Hand Fire Extinguishers shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the rules of the National Fire Protection Association and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal labels soldered to the fronts of the cylinders, reading:

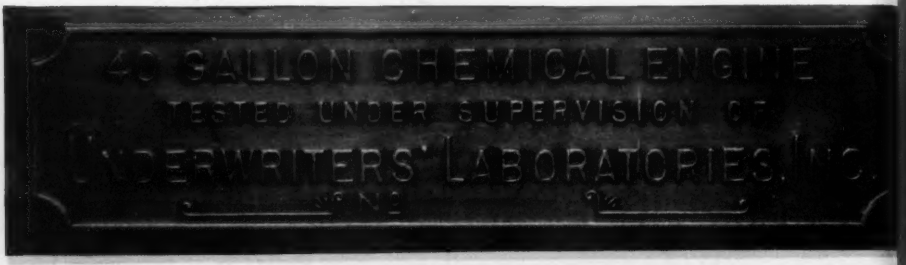
The following companies are equipped to supply these devices:

Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Boston, Knight & Thomas, Inc., 99 State Street.
Buffalo, Western Inspection Co., 45 N. Division Street.
Chicago, Miller Chemical Engine Co., 149 E. Huron Street.
Chicago, Staff Fire Extinguisher Co., 95 and 97 Orleans Street.
Cincinnati, Harker Mfg. Co., 118 W. Second Street.
Columbus, National Fire Equipment Co., 192 E. Long Street.
Columbus, Seagrave Company, South High Street.
Elmira, N. Y., American-LaFrance Fire Engine Co.
Minneapolis, Minn., Northern Fire Apparatus Co., 1301-1307 Third Street, South.
Montreal, Can., The Garth Co., 26-32 Craig Street.
Newark, N. J., The Tea Tray Company of Newark, N. J., Mulberry and Murray Streets.
Petrolia, Ont., Canada, Stempel Mfg. Co., Ltd.
Philadelphia, James Boyd & Bro., 14 North Fourth Street.
Philadelphia, National Inspection Co., 418-422 Sansom Street.
Pittsburg, Fire Extinguisher & Supply Co., 1414-1422 Spring Garden Avenue, N. S.
Pittsburg, Pittsburg Lamp, Brass & Glass Co.
Racine, Wis., Racine Iron & Wire Works, 1022 Douglas Avenue.

St. Louis, Frank & St. Gemme Mfg. Co., 815-817 Market Street.
St. Louis, Missouri Lamp and Mfg. Co., 116 Elm Street.
St. Louis, Stempel Fire Extinguisher Co., 4250 North 20th Street.
Toronto, Canada, Victor Fire Extinguisher Company, 704 Continental Life Building.
Utica, O. J. Childs Co., 50 Liberty Street.

CARBONIC ACID GAS FIRE EXTINGUISHERS, 40 Gallons.

Carbonic Acid Gas Fire Extinguishers of 40 gallons capacity mounted on wheels, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association and examined and tested at factories and passed by Underwriters' Laboratories, Inc., have metal labels soldered to the front of the cylinder reading:



The following companies are equipped to supply these devices:

Boston, Badger Fire Extinguisher Co., 32 Portland Street.
Elmira, N. Y., American-La France Fire Engine Co.

DOORS AND SHUTTERS
for Openings in Fire Walls.

Tin-Clad Fire Doors and Shutters.

Standard Tin-Clad Fire Doors, shown by tests and examinations conducted by Underwriters' Laboratories, to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the tin plates or by attaching brass labels, reading:

The following companies are equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Akron, O., The Kasch Roofing Co., 16-24 Canal Street.
Atlanta, Ga., Dowman & Dozier, 20-22 Trinity Avenue.
Aurora, Ill., National Fire Door Co.
Brooklyn, Hiram A. Akerly, 173 Berry Street.
Buffalo, Chas. Bauers' Sons, 159 William Street.
Buffalo, Philip Christmann & Sons, Corner Virginia and Orange Streets.
Buffalo, Dusing & Hunt, 76 Main Street.
Buffalo, Machwirth Bros. Co., 201-209 Oak Street.
Buffalo. G. H. Peters & Co., 289-293 Oak Street.
Chicago, J. L. Lyon, 83-85 Walnut Street.
Chicago, J. C. McFarland & Co., 27th Street and Fifth Avenue.
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues.
Cincinnati, J. H. Shields, 231 Sycamore Street.
Cleveland, J. Callaghan & Son, 1119 Superior Avenue, near Twelfth Street, N. E.
Cleveland, Cleveland Metal Roofing & Ceiling Co., 3103-3105 Detroit Avenue.
Cleveland, Cleveland Sheet Metal Works, 6933-5 Superior Avenue.
Cleveland, Mannen & Esterly Co., 2241-2255 St. Clair Avenue, N. E.
Cleveland, The O'Donnell Safety System Co., 3062 Superior Avenue, N. E.
Cleveland, The Ohio Roofing Co., 1477 Euclid Avenue.
Cleveland, Riester & Thesmacher Co., 325-329 Pearl Street.
Cleveland, Rudolph & Sons Co., 1416-1420 Prospect Avenue, N. W.
Columbus, Kinnear & Gager Mfg. Co., 326 Mt. Vernon Avenue.
Columbus, National Fire Equipment Co., 192 E. Long Street.
Hoboken, N. J., Leonard Sheet Metal Works, 215-221 Grand Street.
Holyoke, Mass., Coburn Trolley Track Manufacturing Co.
Kansas City, Geo. W. Johnson Mfg. Co., 209-11 W. 17th Street.
Milwaukee, Biersach & Niedermeyer Co., 220 Fifth Street.
Milwaukee, Consolidated Sheet Metal Works, 661-673 Hubbard Street.
Minneapolis, Stremel Bros. Roofing & Cornice Co., 1215-1219 Washington Avenue.
Minneapolis, Variety Fire Door Co., 123 Western Avenue.
Newburyport, Mass., Victor Manufacturing Co.
New Orleans, American Sheet Metal Works, Carrollton Avenue and Edinburgh Street.
New Orleans, Estate of R. G. Holtzer, 317-323 Burgundy Street.
New Orleans, A. J. Nelson Manufacturing Co., Ltd.
New Orleans, New Orleans Roofing and Metal Works, Scott, Toulouse, St. Louis Streets and Carrollton Avenue.
New York, J. F. Blanchard Co., 23d and Broadway.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Manhattan Fireproof Door Co., 412-422 E. 125th Street.
New York, John W. Rapp, 1 Madison Avenue.
New York, M. F. Westergren, Inc., 213-221 E. 144th Street.
Philadelphia, David Luptons Sons Co., Allegheny Avenue and Tulip Street.
Philadelphia, The J. S. Thorn Co., 20th and Allegheny Avenue.
Richmond, Ind., Richmond Safety Gate Co.
San Francisco, Rulofson Metal Window Works, 315-319 Monadnock Building.
St. Louis, Albert & Fischer Hardware & Sheet Metal Co., 2529 South Broadway.
St. Louis, Caplan Galvanized Iron Cornice Co., 4412-4414 Easton Avenue.
St. Louis, J. Eberle & Son, 2014-2016 Laclede Avenue.
St. Louis, Gerock Bros. Mfg. Co., 1352 Old Manchester Road.
St. Louis, O. K. Harry Steel Works, 2333-5 Papin Street.
St. Louis, Frank B. Higgins, 924 North Sixth Street.
St. Louis, Hopmann Cornice Co., 2500-2 North Jefferson Avenue.
St. Louis, Mesker & Bro., 421-519 S. Sixth Street.
St. Louis, Missouri Fire Door Co., 100 South Commercial Street.
St. Louis, E. Murphy & Co., 3727-3731 Easton Avenue.

St. Louis, Powers & Boyd Cornice and Roofing Co., 3614-16 Laclede Avenue.
St. Louis, Richmond Safety Gate Co., 1117 Chemical Building.
St. Louis, Ruth Cornice Co., 4299 Easton Avenue.
St. Louis, St. Louis Fire Door Co., Cass and Collins Streets.
St. Louis, E. E. Souther Iron Co., 2206 North Second Street.
St. Louis, Standard Fire Door and Contracting Co., 3025 Texas Avenue.
St. Louis, Van der Au & Cluss Mfg. Co., 2408 So. Jefferson Avenue.
St. Louis, Wand & Niehaus, 3008 Kossuth Avenue.
St. Louis, West End Cornice Works, 4740 Delmar Avenue.
St. Paul, Perkins Mfg. Co., Corner Fairview and University Avenues.
West New York, N. J., A. J. Ellis.
Toronto, Ont., Can., Douglas Brothers, 124 Adelaide Street, West.
Toronto, Ont., Can., A. B. Ormsby, Ltd., 161-165 Queen Street, E.

Metal Fire Doors and Shutters.

Three-inch fire door, made of No. 24 U. S. gauge crimped galvanized steel in horizontal sections 8 inches wide filled with mineral fibre.

Doors of this type shown by tests and examinations conducted by Underwriters' Laboratories to be the equivalent of the standard 2½-inch fire door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by stamping in the plates or attaching brass labels, as shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Philadelphia, David Luptons Sons Co., Allegheny Avenue and Tulip Street.

Metal Fire Doors.

Door made of two thicknesses No. 22 U. S. gauge corrugated galvanized sheet steel, with 1-16-inch sheet asbestos between. Corrugated steel sheets on opposite sides of door are bolted and riveted together only at edges. Doors stiffened by flat bars and galvanized iron channels at edges.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard 2½-inch fire door for openings **not exceeding six feet in width** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these doors. Underwriters having jurisdiction should be consulted in all cases before installations are made.

Memphis, Tenn., Saino Fire Door & Shutter Co., Tennessee Trust Building.

Composition Fire Doors.

Two-inch solid door made of Sagax wood reinforced by ⅛-inch round steel rods in both directions, located in middle of door, rods interlaced and extend close to edges of door. Vertical rods spaced not exceeding 4 inches and twisted around ¼-inch horizontal rod at top. Horizontal rods spaced not exceeding 6 inches.

Doors of this type shown by tests and examinations conducted by the Underwriters' Laboratories to be the equivalent of the standard tin-clad door for openings **not exceeding 80 square feet in area** and examined at factories and passed by Underwriters' Laboratories, Inc., are labeled by attaching brass label shown above.

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Baltimore, Md., The Sagax Wood Co., 106 Dover Street.

Double Steel Rolling Fire Doors.

For openings not exceeding 8 feet wide and 9 feet high where standard fire doors cannot be employed.

Doors examined at factory and passed by Underwriters' Laboratories, Inc., have labels attached to the bottom bar reading:

The following company is equipped to supply these devices. Underwriters having jurisdiction should be consulted in all cases before installation is made.

Columbus, O., Kinnear Mfg. Co., Marking, "Abacus No. 3."

CORRIDOR OR PARTITION DOORS

Not for Openings in Fire Walls.

Doors shown by tests and examinations conducted by Underwriters' Laboratories, Inc., to possess sufficient fire retardant value to warrant approval in corridors and partitions but **not for openings in fire walls** (see list of Fire Doors and Shutters), and examined at factories and passed by Underwriters' Laboratories, Inc., bear etched brass labels attached to the back edge reading:

The following companies are equipped to supply these devices in the types indicated:

Metallic Doors.

Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door, frame, trim.
Chicago, Voigtmann & Co., 42-54 E. Erie Street. 2-inch door, frame, trim.
Jamestown, N. Y., American Metal Door Co., Jamestown, 1⅝-inch door, frame, trim.
Jamestown, N. Y., Dahlstrom Metallic Door Co., Jamestown. 1½-inch door, frame, trim.
Minneapolis, Northwestern Roofing, Cornice & Stamping Works, 1113 S. Fifth Street. 2-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1 13-16-inch door. Door only.
New York, John W. Rapp, 1 Madison Avenue. 1¾-inch door, frame, trim.
Youngstown, O., General Fireproofing Co., Youngstown. 2-inch door, frame, trim.

Metal Clad Doors.

Chicago, Knisely Bros., 5th Avenue and 28th Place. 2-inch door only.
Minneapolis, Thorp Fireproof Door Co., 1600-1616 Central Avenue. 1⅞-inch door, frame, trim.
Minneapolis, Thorp Fireproof Door Co., 1600-1616 Central Avenue. 2⅛-inch door, frame, trim.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 1⅞-inch door only.
New York, J. F. Blanchard Co., Broadway and 23rd Street. 2⅞-inch door only.
New York, Howell & Lawrence, 1788 First Avenue. 1⅞-inch door only.
New York, Manhattan Fireproof Door Co.. 412-422 E. 125th Street. 1⅞-inch door only. Known as "Standard A."
New York, Manhattan Fireproof Door Co.. 412-422 E. 125th Street. 1⅞-inch door only. Known as "Standard B."

Composition Doors.

Baltimore, Md., Sagax Wood Co., 106 Dover Street. 1¾-inch door and frame. Known as "Perfection."

STAIR OR ELEVATOR DOORS
Not for Openings in Fire Walls.

Doors shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels screwed or riveted to the edge of the door reading:

The following companies are equipped to supply these devices:

Chicago, Variety Mfg. Co.
Columbus, O., The Kinnear Mfg. Co.
Jamestown, N. Y., American Metal Door Co.
Jamestown, N. Y., Dahlstrom Metallic Door Co.
Minneapolis, Northwestern Roofing, Cornice and Stamping Works, 1113 S. Fifth Street.
Minneapolis, Thorp Fireproof Door Co., 1600-1616 Central Avenue.
New York, J. F. Blanchard Co., Broadway and 23d Street.
New York, Howell & Lawrence, 1788 First Avenue.
New York, Manhattan Fire Proof Door Co., 412-422 E. 125th Street.
Youngstown, O., General Fireproofing Co.

DOOR AND SHUTTER HARDWARE.

Standard 3½x⅜-inch hardware for sliding doors only, shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll reading as follows:

A tag is also attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain, as follows:

1. One 3½x⅜-inch track, length to be equal to twice the width of the door opening, plus 21 inches. Punched for wall bolts. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two 3½x⅜-inch binders. 4. One 2½x⅛-inch stay roll. Stay roll should be the type specified for the form of sill used and should include all bolts except wall bolts. 5. One cast-iron bracket for each track bolt. 6. Two ¾x¼-inch half oval chafing strips for back of door, two 1x⅛-inch flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1½x⅛-inch strip 5 inches less than width of door to take wear of stay roll. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. 12. One washer for each wall bolt, including those for binders and stay roll. 13. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Aurora, Ill., Richards Mfg. Co. Marking, "Monarch A."
Aurora, Ill., Wilcox Mfg. Co. Marking, "Wilcox 501-A."
Cleveland, O'Donnell Safety System Co., Corner Superior Avenue and 31st Street, N. E. Marking, "O'Donnell A."
Chicago, Variety Mfg. Co., Carroll and Sacramento Avenues. Marking, "Variety A."
Holyoke, Mass., Coburn Trolley Track Mfg. Co. Marking, "Coburn A."
Newburyport, Mass., Victor Mfg. Co. Marking, "Victor A."
New York. The McCabe Hanger Mfg. Co., 425-427 W. 25th Street. Marking, "'A' McCabe."
Philadelphia Jas. Peters & Son, 1934-38 N. Front Street. Marking, "Peters A."
Richmond, Richmond Safety Gate Co. Marking, "A. Richmond."
South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "No. 20-A. Wilbern."
St. Louis, Mesker & Bro., 421-519 South Sixth Street. Marking, "Mesker & Bro. 'A'."

Specially designed malleable iron hardware for sliding fire doors, which is considered to be the full equivalent of the 3½x⅜-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of the pieces which a complete set should contain as follows:

1. One 1 7-16-inch tubular track, length to be equal to twice the width of door opening, plus 14 inches. 2. Two hangers for openings six feet and less in width, three hangers for openings wider than six feet, and bolts for attaching hangers to door. 3. Two malleable iron binders. 4. One malleable iron stay roll. 5. Brackets to carry track, including two special end supports. 6. Two ¾x¼-inch half oval chafing strips for back of door, two flat strips for front of door opposite the oval strips. Bolts for fastening above strips together through the door. Length of above strips to be 4 inches less than door opening. 7. One 1½x⅛-inch strip 5 inches less than width of door to take wear off stay roll, with wood screws for attaching. 8. One malleable iron wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper. 11. Four bumper shoes and screws for attaching. 12. One washer for each wall bolt, including those for binders, bumpers and stay roll.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following companies are equipped to supply this hardware:

Chicago, Allith Manufacturing Co., Taylor Street and 43d Avenue. Marking "Allith A-06."
Hamilton, Can., Allith Mfg. Co. Marking, "Allith H."

Specially designed malleable iron hangers, tubular steel track and malleable iron brackets for sliding fire doors, which are considered to be the full equivalent of 3½x⅜-inch steel hardware made in accordance with the requirements of the National Board of Fire Underwriters, approved in combination with the balance of the set of standard 3½x⅜-inch steel hardware and examined at factory and passed by Underwriters' Laboratories, Inc., can be distinguished by approved name and issue mark on each piece in the set and by labels applied to each hanger, binder and stay roll as shown above.

A special tag is attached to one hanger of each set on which is printed a list of pieces which a complete set should contain as follows:

1. One 1¾-inch tubular steel track, length to be equal to twice the width of the door opening, plus 14 inches. 2. Two hangers for openings six feet and less in width; three hangers for openings wider than six feet. Bolts for attaching hangers to door. 3. Two 3½x¾-inch binders. 4. One 2½x½-inch stay roll. Stay roll should be the type specified for the form of sill used, and should be provided with all bolts except wall bolts. 5. Malleable iron brackets for carrying track, including two special end supports. 6. Two ¾x¼-inch half oval chafing strips for back of door; two flat strips for front of door opposite chafing strips. Bolts for fastening strips together through door. Length of above strips to be 4 inches less than door opening. 7. One 1½x¼-inch strip 5 inches less than width of door. Wood screws for attaching. 8. One wedge with screws for attaching. 9. One bow-shaped handle and one flush pull with bolts and screws for attaching. 10. One front bumper and one back bumper, identical with, and in addition to binders. 11. Four bumper shoes and screws for attaching. 12. One washer for each wall bolt, including those for binders, bumpers and stay roll. 13. One instruction card for mounting.

Where the hardware for a single fire door on each side of the fire wall is bolted together through the wall, the washers above specified are unnecessary.

Wall bolts are not included, as the requirements for length vary in each case. Automatic attachments are not as yet included in a standard set of hardware.

The following company is equipped to supply this hardware:

Aurora, Ill., Wilcox Manufacturing Co. Marking, "Wilcox No. 645."

HANGERS ONLY.

Specially designed adjustable malleable iron hanger for sliding fire doors. Approved only in combination with a complete set of approved fixtures for sliding doors, and in locations where an adjustable hanger is acceptable to Underwriters having jurisdiction. Hangers examined at factory and passed by Underwriters' Laboratories, Inc., may be distinguished by approved name and issue mark and by labels shown above.

The following company is equipped to supply this hardware:

South Milwaukee, Wis., Stowell Manufacturing & Foundry Co. Marking, "Wilbern No. 4A."

EXTINGUISHER, Miscellaneous.

Waggoner Sanatory Fire Bucket.

This pail as submitted complied with the National Fire Protection Association rules in details of construction and was designed in a manner which effectually protects its contents from evaporation and foreign matter.

Where it is desired to protect the contents of exposed pails against freezing by the addition of calcium chloride or other salts underwriters having jurisdiction should be consulted.

The following company manufactures this bucket:

Chicago, Ill., Waggoner Sanatory Fire Bucket Co.

FIRE DOORS. (See Doors and Shutters.)

FUSIBLE LINK.

The fusible link manufactured by the following company for use in connection with automatic closing devices for doors and windows, and automatic devices requiring fusible links where the loads to which the link is subjected do not exceed the following:

5 lbs. where a factor of safety of 5 is required.
6 1-4 lbs. where a factor of safety of 4 is required.
8 1-3 lbs. where a factor of safety of 3 is required.

is approved.

Chicago, Voigtmann & Co., 42-54 E. Erie Street.

GLASS. (See Wired Glass.)

HARDWARE. (See Door and Shutter Hardware; also Window Hardware.)

HEAT INSULATING COVERINGS.

The following material is approved for heat insulating purposes for walls, floors and ceilings in cold storage warehouses, cold storage cellars in breweries, cold rooms in packing houses, hotel refrigerators, fur storage rooms and rooms of this character.

Cork Board (Nonpareil) laid in cement mortar. Manufactured by Armstrong Cork Co., Pittsburg, Pa.

HOSE.

2½ Inch Cotton Rubber-Lined.

Private Fire Department Hose for outside use shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by red rubber label attached to each 50 foot length **with couplings attached** reading:

And by slate colored label attached to each 50 foot length **without couplings** reading:

The following companies are equipped to supply this material:

Akron, O., B. F. Goodrich Co.
Boston, Mass., Boston Woven Hose and Rubber Co.
New York, Fabric Fire Hose Co., Corner Duane and Church Streets.
New York, Manhattan Rubber Mfg. Co., 18 Vesey Street.

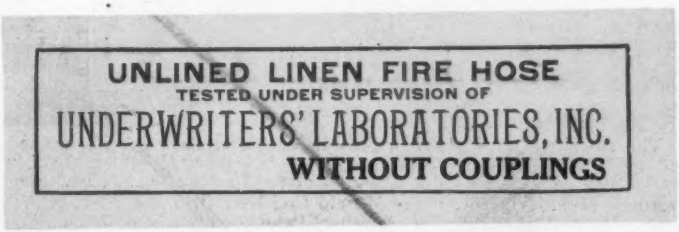
Before the extension of the label service to this industry approvals were granted to certain brands of hose manufactured by the foregoing and other companies as follows:

Afmic, New York Belting and Packing Co., Ltd., 91 Chambers Street, New York.
American, Boston Belting Co., 256 Devonshire Street, Boston, Mass.
G. P., Gutta Percha and Rubber Mfg. Co., 126 Duane Street, New York.
Guttaperch, Gutta Percha and Rubber Mfg. Co. of Toronto, Ltd., 47 Yonge Street, Toronto, Ont.
Star, Canadian Rubber Co., Notre Dame Street and Papineau Avenue, Montreal, Can.
Tuebor, New Jersey Car Spring and Rubber Co., Wayne and Brunswick Streets, Jersey City, N. J.
2-X-L, Mechanical Rubber Co., Cleveland, O.
U. S., Eureka Fire Hose Mfg. Co., 13 Barclay Street, New York.

Unlined Linen.

Unlined Linen Fire Hose for use inside buildings shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each length **with couplings attached** reading as follows:

And by label attached to each length **without couplings** reading:



The following companies are equipped to supply this material:

Boston, Mass., Boston Woven Hose and Rubber Co.
Malden, Mass., Chas. Niedner's Sons Co., 10-20 James Street.
New York, Eureka Fire Hose Mfg. Co., 13 Barclay Street.

HYDRANTS.

The hydrant manufactured by the following company has been examined and tested and pending the adoption of revised specifications for construction of devices of this class is recommended for use in connection with mill yard and other private underground fire mains. Service record generally satisfactory.

Indian Orchard, Mass. Chapman Valve Mfg. Co.

PAINTS, FIRE RETARDANT.

These coatings for wood and other similarly combustible building materials which come under this class, or property so coated, should in no sense be considered as "fireproof." Their use is preferable to leaving the material uncoated because they retard the spread of fire over combustible surfaces and are particularly desirable in lieu of varnish, shellac, or oil finish, which latter serve to rapidly spread fire. Attention is called, however, to the need of renewal of the coatings in order to maintain the desired conditions.

Whitewash so well meets the requirements of this class that we print formula recommended by the Lighthouse Board of the United States Treasury Department as follows:

"Slake one-half bushel of unslaked lime with boiling water, keeping it covered during the process; strain it and add a peck of salt dissolved in warm water; three pounds of ground rice, put in boiling water and boil to a thin paste; one-half pound powdered Spanish whiting and a pound of clear glue dissolved in hot water; mix these well together and let the mixture stand for several days. Keep the wash thus prepared in a kettle or portable furnace and when used put it on as hot as possible with painter's or whitewash brushes."

Where possible the coatings should be applied by a hand brush rather than by a spraying machine, thus effecting a better surface, and special care should be exercised not to coat sprinkler heads where installed.

Bay State Brick and Cement Coating. Manufactured by Wadsworth, Howland & Co., 82-84 Washington Street, Boston, Mass.

This coating is put up in cans and barrels and sold as a ready-mixed paint. The product examined at the factory and passed by Underwriters' Laboratories, Inc., can be distinguished by label attached to each container reading as follows:

The so-called "cold water" paints listed below have been examined and tested.

Asbestine. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.

Carey's. Manufactured by The Neptune Paint Co., Hudson, Mich., for The Philip Carey Mfg. Co., Cincinnati, O.

Decorine. Manufactured by Benj. Moore & Co., 111 N. Green Street, Chicago.

Hygienic Fireproof Calcimine. Manufactured by The Rubber Paint Co., 154 W. Van Buren Street, Chicago.

Indeliblo. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.

Indurine. Manufactured by The Muralo Co., New Brighton, S. I., N. Y.

J. M. Manufactured by The Neptune Paint Co., Hudson, Mich., for H. W. Johns-Manville Co., Milwaukee, Wis.

Monarch. Manufactured by Geo. Fletcher & Co., 49-51 N. Ashland Avenue, Chicago.

Nepolite. Manufactured by The Neptune Paint Co., Hudson, Mich.

Retardo. Manufactured by Benj. Moore & Co., Chicago, for Retardo Fire Proof Paint Co., Milwaukee, Wis.

PLAY PIPE.

The National Standard Play Pipe for 2½ inch hose manufactured by the following manufacturer has been examined and tested and approved for use:

New York, Eureka Fire Hose Manufacturing Co., 13 Barclay Street.

PUMPS.

National Standard Steam Fire Pump, 1,000 Gallon Size.

The first pump of this character built by the following manufacturer has been examined and tested, and is in all essential particulars in compliance with National Standard specifications. The manufacturers' test facilities, however, are inadequate for test of pumps of this size, and improvement in this respect and further tests of later pumps when built have been recommended.

Battle Creek, Mich., Advance Pump and Compressor Co.

ROOFINGS.

Certain proprietary roofings listed below have been examined and tested.

These tests indicate that the fire retardant properties of these materials are inferior to those of slate, metal or good tin-clad roofs, but in a class with those of good slag and good gravel roofs, and superior to those of wooden shingle roofs.

Armco (Prepared, 2 ply), All Roofing Manufacturing Co., East St. Louis, Ill.

Arrow Brand Asphalt Ready Roofing (Prepared, 2 ply), Asphalt Ready Roofing Co., 136 Water Street, New York.

Amatite (Prepared), Barrett Manufacturing Co., 17 Battery Place, N. Y.

Amazon Ready Roofing, (Prepared, 2 and 3 ply), Barrett Mfg. Co., Philadelphia, Pa.

Becker Asphaltum Ready Roofing, (Prepared, 2 and 3 ply), F. Becker Asphaltum Ready Roofing Co., 1510-12 Milwaukee Avenue, Chicago, Ill.

Black Diamond, (Prepared, 2 and 3 ply), Barrett Mfg. Co., 17 Battery Place, N. Y.

Carbonite (Prepared, 2 and 3 ply), The Heppes Co., 2427 Fillmore Street, Chicago.

Carey's Standard Magnesia Flexible Cement (Prepared), The Philip Carey Mfg. Co., Lockland, Cincinnati, O.

Climax Asphalt (Prepared, 2 and 3 ply), McHenry-Millhouse Mfg. Co., South Bend, Ind.

Congo (Prepared, 2 and 3 ply), The Buchanan-Foster Co., 504 West End Trust Bldg., Philadelphia, Pa.

Eclipse Rubber (Prepared), Ford Manufacturing Co., Washington and Desplaines Street, Chicago, Ill.

Ehrets (Slag), Warren-Ehret Co., 1202 Land Title Bldg., Philadelphia.

Elaborated Ready (Prepared), Elaborated Ready Roofing Co., 4419 La Salle Street, Chicago.

Elaterite (Prepared), Western Elaterite Roofing Co., 841-4 Equitable Building, Denver, Col.

Flexo (Prepared, 2 and 3 ply), The Heppes Co., 2427 Fillmore Street, Chicago.

Galvanized Rubber (Prepared), Ford Manufacturing Co., Washington and Desplaines Streets, Chicago, Ill.

Genasco (Prepared, Smooth Surface, 2 and 3 ply, Stone Surface, Whitestone and Model, 2 ply), The Barber Asphalt Paving Co., Philadelphia, Pa.

Granite (Prepared), The Eastern Granite Roofing Co., 1 Hudson Street, New York, N. Y.

Huttig Rubber (Prepared, 2 and 3 ply), Barber Asphalt Paving Co., 1243 Stock Exchange Bldg., Chicago, for Huttig Mfg. Co., Muscatine, Iowa.

Indruroid (Prepared, 2 and 3 ply), H. F. Watson Co., Erie, Pa.

Malthoid (Prepared, 2 and 3 ply), The Paraffine Paint Co., Merchants Exchange Bldg., San Francisco, Cal.

Mastic (Prepared), National Mastic Roofing Co., San Francisco, and National Roofings and Materials Co., Edwardsville, Ill.
Mikado (Prepared, 2 and 3 ply), J. A. & W. Bird & Co., 35 India Street, Boston.
Monarch (Prepared, 2 and 3 ply), Stowell Mfg. Co., Jersey City, N. J.
No-Tar (Prepared, 2 and 3 ply), The Heppes Co., 2427 Fillmore Street, Chicago.
Paroid (Prepared, 2 and 3 ply), F. W. Bird & Son, East Walpole, Mass.
Protection Brand Asphalt Ready Roofing (Prepared), Asphalt Ready Roofing Co., 136 Water Street, New York.
Rex Flintkote (Prepared, 2 and 3 ply), J. A. & W. Bird & Co., 35 India Street, Boston.
Rhinoceros (Prepared, 2 and 3 ply), Warren Chemical and Manufacturing Co., 17 Battery Place, New York.
Roofbestos (Prepared, 2 and 3 ply), Roofbestos Mfg. Co., St. Louis, Mo.
Roofrite (Prepared), The Lehon Co., W. 43rd Street, Lincoln to Robey, Chicago.
Rubber (Prepared, 2 and 3 ply), The General Roofing Co., East St. Louis, Ill.
Rubbertex (Prepared, 2 and 3 ply), The Heppes Co., 2427 Fillmore Street, Chicago.
Ruberoid (Prepared, 2 and 3 ply), Standard Paint Co., 100 William Street, New York.
Safety (Prepared), National Roofing Co., Tonawanda, N. Y.
Security (Prepared), National Roofing Co., Tonawanda, N. Y.
Standard Asbestos (Prepared), H. W. Johns-Manville Co., 100 William Street, New York.
Stowell's Slag (Slag), Stowell Mfg. Co., Jersey City, N. J.
Veribest Rubber (Prepared, 2 and 3 ply), McHenry-Millhouse Mfg. Co., South Bend, Ind.
Vulcanite (Prepared, 2 and 3 ply), The Patent Vulcanite Roofing Co., 625 S. Campbell Avenue, Chicago.
Walrus (Prepared, 2 and 3 ply), Warren Chemical and Manufacturing Co., 17 Battery Place, New York.
West Coast Ready Rock (Prepared), The West Coast Company, Waukegan, Ill.

Shingles.

Winthrop Asphalt Shingles. Winthrop Asphalt Shingle Co., Chicago. **Rated as ordinary wooden shingles.**

SASH CHAIN. (See Window Hardware.)

SASH LOCK. (See Window Hardware.)

SHUTTERS. (See Doors.)

SPRINKLERS, Automatic.

It has not been judged necessary as yet to extend label service to these devices.

The following patterns are approved:

Grinnell Improved 1903. General Fire Extinguisher Co., Providence, R. I.
International, Evans 1902 Model. International Sprinkler Co., 517 Arch Street, Philadelphia, Pa.
Manufacturers "C." Manufacturers' Automatic Sprinkler Co., 1-11 Liberty Street, New York.
Neracher Improved 1902. General Fire Extinguisher Co., Providence, R. I.
Niagara-Hibbard, issue B, 1904. Niagara Fire Extinguisher Co., Akron, O.
Rockwood, issue A. Rockwood Sprinkler Co., 4 Arch Street, Worcester, Mass.

SPRINKLER SUPERVISORY DEVICES.

For use in connection with approved central station systems.

Consists of apparatus for transmitting signals when gate valves are closed or open; when water in tanks falls below or is restored to predetermined level; when pressure in air tanks falls below or is restored to predetermined amount; when water in tanks falls below or rises above predetermined temperatures. Also apparatus for connection with water flow valves to transmit water flow signals (where there is a flow of water equal to that of one or more sprinklers) and to withhold signals from water surges or variable pressure.

A. D. T. Devices for attaching to Central Station Signaling Systems for supervisory maintenance and operation of sprinkler equipments. Manufactured by Automatic Fire Protection Company, New York and Chicago.

THERMOSTATS.

"Aero" Automatic Fire Alarm.

This system utilizes the principle of the expansion under heat of air contained in a small copper tube which is installed along ceilings or piping. Tube leads to contact closing and test devices of special type. The expansion of air in tube actuates a diaphragm closing an electric circuit whereby signal is transmitted.

This device as sold by the following company is **approved** subject to the following conditions:

1. Underwriters having jurisdiction to be consulted in all cases before installations are made.
2. Tubing to be installed to comply as to location, distribution and spacing with requirements for thermostats of electric automatic fire alarms.
3. Central station equipments, local equipments, electric devices and circuits and other portions of this system other than the tubing and the pneumatic devices connected with it to comply in all respects with the requirements for similar portions of automatic fire alarm systems.
4. Labels. Tubing for this system constructed according to approved specifications and examined and tested at factory under the supervision of Underwriters' Laboratories, Inc., bears tag reading: "Underwriters' Laboratories, Inspected Tubing for Automatic Fire Alarm, No....." One such tag for each 100 feet of tubing installed should be preserved in transmitter case at risk as permanent record of tubing used. Each Detector, Annunciator and Transmitter for this system constructed according to approved specifications and examined and tested at factory under supervision of Underwriters' Laboratories, Inc., bears metal label reading: "Underwriters' Laboratories, Inspected Automatic Fire Alarm Device, No....."

Denver, Colorado. Frederick Thomas, Coronado Building, Agent for United States and Canada, for English Patentees.

VALVES, ALARM. (See also Sprinkler Supervisory Devices.)

No appliances meeting all of the requirements desirable for this service have as yet been shown.

Ratings covering the patterns found in common use have been issued as follows:

Evans Variable Pressure 1902 model. Manufactured by International Sprinkler Co., 517 Arch Street, Philadelphia. Not standard. Field experience limited, but fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell English Pattern, Variable Pressure (Swing check for Straightway type). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience fairly satisfactory where device has been properly installed, correctly adjusted and intelligently supervised.

Grinnell branch (old type called Harkness Tee). Manufactured by General Fire Extinguisher Co., Providence, R. I. Not standard. Field experience, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Manufacturers. Manufactured by Manufacturers' Automatic Sprinkler Co., 1-11 Liberty Street, New York. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

Niagara. Manufactured by Niagara Fire Extinguisher Co., Akron, O. Not standard. Field experience with an improved type of this valve in one locality, where central station and Local Board supervision obtains and valves are under constant pressure, reported as fairly satisfactory.

VALVES, DRY PIPE.

The following dry pipe valves are approved for use:

Grinnell Straightway. The General Fire Extinguisher Company, Providence, R. I.

International (No. 4 Evans Model), 4-inch size. International Sprinkler Co., Philadelphia, Pa.

Manufacturers, Model 3, 4-inch size. Manufacturers' Automatic Sprinkler Co., New York, N .Y.

Phoenix Mechanical, 5-inch size. Phoenix Fire Extinguisher Co., Chicago, Ill.

Rockwood, 4-inch and 6-inch sizes. Rockwood Sprinkler Co., Worcester, Mass.

WATCHMEN'S TIME RECORDING APPARATUS.

Boxes for Central Station Systems.

Combined Watchmen's Call and Fire Alarm Boxes for use in connection with approved normally closed circuit Central Station Watchmen's Time Recording Apparatus shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to the outside of the clock cases reading:

The following companies are equipped to supply these devices:

American District Telegraph Co., 195 Broadway, New York.
Chicago Electric Protective Co., 147 Fifth Avenue, Chicago.
Signalphone Co., Milwaukee, Wis.
Viaduct Electric Co., 10 S. Howard Street, Baltimore, Md.
Williams Watchman's Clock Co., 608 Washington Loan and Trust Building, Washington, D. C.

Apparatus for Local or Private Systems.

Watchmen's Stationary Clocks shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by label fixed to outside of clock cases reading:

and a decalcomania transfer is applied to the outside of the magneto cases reading:

The following companies are equipped to supply these devices:

American Watchman's Time Detectors Co., 2069 Fourth Street, Cleveland, O.
American Watchman's Time Detectors Co., 234-5 Broadway, New York.
Eco Magneto Clock Co., 289 Congress Street, Boston.
E. A. Hamilton & Co., Grand Rapids, Mich.
E. O. Hausburg, 45 Maiden Lane, New York, N. Y.
Holtzer-Cabot Electric Co., Brookline, Boston, Mass.
E. Howard Clock Co., 373 Washington Street, Boston, Mass.
Newman Clock Co., (Single Station Clock), 1526 Wabash Avenue, Chicago.
Simplex Time Recorder Co., Gardner, Mass.
Standard Watchman's Time Detector Co., (W. Romaine), 1-3 W. Broadway, New York.

Before the extension of the label service to this industry approvals were granted to certain clocks manufactured by the foregoing and one other company as follows:
Wakeman's Single Station. Wakeman's Time Recorder Co., Scranton, Pa.

Portable Clocks.

Watchman's Portable Clocks shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., can be distinguished by labels fixed to the inside of clock cases reading: (*Same as for stationary clocks shown above.*)

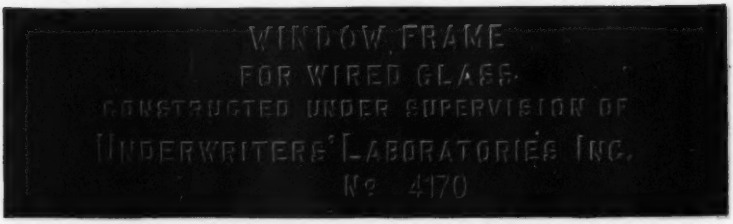
and a decalcomania transfer is applied to outside of the key boxes reading: (*Same as for magneto stations shown above.*)

The following companies are equipped to supply these devices:

Eco Magneto Clock Co., 289 Congress Street, Boston.
General Watchman's Time Detector Co., 27 Pine Street, New York, N. Y.
Hardinge Bros., 1034-1036 Lincoln Avenue, Chicago.
E. O. Hausburg, 45 Maiden Lane, New York.
Nanz Clock Co., 178 Fulton Street, New York.
Newman Clock Co., 1526 Wabash Avenue, Chicago.
The Timekeeper Co., Chicago.

WINDOWS.

Metallic Window Frames and Sash for Wired Glass shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with the requirements of the National Fire Protection Association, and examined at factories and passed by Underwriters' Laboratories, Inc., have metal labels riveted to the inside of the window, reading:



The following companies are equipped to supply these devices:

Allegheny, Allegheny Cornice & Skylight Co., 821 Bouquet Street. Double Hung.

Allegheny, Thos. W. Irwin Mfg. Co., 401-411 Rebecca Street. Double Hung.

Boston, E. B. Badger & Sons Co., 63 Pitts Street. Double Hung, Stationary.

Brooklyn, Herrmann & Grace, 671-685 Bergen Street. Pivoted Upper Sash.

Buffalo, Machwirth Bros. Co., 201-209 Oak Street. Pivoted Upper, Double Pivoted.

Chicago, Grace Cornice Works, 1260 Indiana Avenue. Double Hung.

Chicago, Illinois Roofing & Cornice Co., 329 W. Kinzie Street. Double Hung, Pivoted Upper Sash, Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Stationary, Top Hinged Sash.

Chicago, Knisely Bros., Fifth Avenue and 28th Place. Casement, Double Hung, Pivoted Upper Sash, Stationary, Pivoted Upper and Lower, Top Hinged, Single Pivoted.

Chicago, Harry C. Knisely Co., 273 S. Canal Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Stationary, Top Hinged, Pivoted Lower, Top Hinged Upper and Stationary Lower.

Chicago, J. C. McFarland & Co., 27th Street and Fifth Avenue. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower Sash, Fixed Upper and Pivoted Lower Sash, Single Pivoted, Top Hinged, Stationary Lower and Top Hinged Upper Sash, Stationary.

Chicago, Jas. A. Miller & Bro., 129 S. Clinton Street. Double Hung, Pivoted Upper Sash, Stationary, Pivoted Lower, Pivoted Upper and Lower, Single Pivoted, Top Hinged.

Chicago, Perkinson & Brown, 111 N. Lincoln Street. Pivoted Upper Sash, Pivoted Upper and Lower, Top Hinged, Stationary Lower and Top Hinged Upper, Stationary, Single Pivoted, Pivoted Lower.

Chicago, E. A. Rysdon & Co., 627-629 W. 41st Street. Double Hung, Pivoted Upper Sash.

Chicago, Sykes Steel Roofing Company, 112-120 W. 19th Place. Double Hung, Pivoted Upper (two types), Pivoted Upper and Lower, Pivoted Lower, Single Pivoted, Stationary, Top Hinged, Twin Pivoted Upper, Twin Top Hinged, Twin Double Hung.

Chicago, Voigtmann & Co., 42-54 E. Erie Street. Pivoted Upper Sash. Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Three Pivoted, Three Sash, Upper and Lower Stationary, Middle Pivoted, Twin Pivoted, Twin Stationary, Double Hung, Top Hinged Sash, Stationary, Top Hinged Upper and Stationary Lower Sash, Casement.

Cincinnati, Edwards Mfg. Co., Eggleston Avenue, 4th and 5th Streets. Double Hung.

Cincinnati, Jacob Freund Roofing Co., B. & O. S. W. Ry., near Mitchell Avenue. Pivoted Upper Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash.

Cincinnati, Thomas Lee, 128 W. Second Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower Sash, Pivoted Lower, Single Pivoted, Hinged.

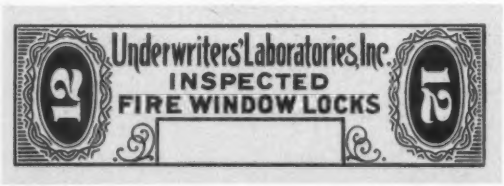
Cincinnati, Witt & Brown, 215 W. Third Street. Pivoted Upper Sash, Pivoted Upper and Lower, Double Hung.
Cleveland, Ohio Roofing Co., 1477 Euclid Avenue. Double Hung.
Cleveland, Riester & Thesmacher Co., 1514-1526 W. 25th Street. Pivoted Upper Sash, Double Hung.
Columbus, F. O. Schoedinger, 146-148 N. Third Street. Double Hung.
Detroit, W. J. Burton Co., 164-166 W. Larned Street. Double Hung.
Galveston, Fedder & Co., 2624 Mechanics Street. Double Hung.
Hoboken, Leonard Sheet Metal Works, 215-21 Grand Street. Double Hung.
Kansas City, J. A. Ritzler Cornice & Ornament Co. Double Hung, Pivoted.
Kansas City, Henry Weis Cornice Co., 1811-15 Wyandotte Street. Pivoted Upper Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Stationary, Double Hung.
Kansas City, Zahner Mfg. Co., 12 West 10th Street. Double Hung, Pivoted Upper, Pivoted Upper and Lower, Single Pivoted, Hinged.
Los Angeles, California Cornice Works, 1610-14 San Fernando Street. Double Hung.
Milwaukee, Biersach & Niedermeyer Co., 216-220 Fifth Street. Pivoted Upper Sash, Pivoted Lower, Pivoted Upper and Lower, Single Pivoted, Stationary.
Milwaukee, Consolidated Sheet Steel Metal Works, 661 Hubbard Street. Pivoted Upper, Pivoted Upper and Lower Sash, Fixed Upper and Pivoted Lower Sash, Single Pivoted, Stationary, Double Hung, Top Hinged.
Minneapolis, Stremel Bros. Roofing & Cornice Co., 1215-19 Washington Avenue. Double Hung.
New Orleans, American Sheet Metal Works, Carrollton Avenue and Edinburg Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower, Single Pivoted, Stationary.
New Orleans, A. J. Nelson Mfg. Co. Double Hung.
New York, J. F. Blanchard Co., Broadway and 23d Street. Double Hung, Pivoted Upper Sash, Pivoted Upper and Lower, Single Pivoted, Stationary.
New York, The Geo. Hayes Co., 71 Eighth Avenue. Pivoted Upper Sash.
New York, Voigtmann & Co., 427 W. 13th Street. Pivoted Upper Sash, Double Hung, Pivoted Lower Sash, Pivoted Upper and Lower, Single Pivoted, Top Hinged, Stationary, Three Pivoted, Two Pivoted and Stationary Lower, Stationary Lower and Top Hinged Upper, Counterbalanced.
New York, M. F. Westergren, Inc., 213-221 E. 144th Street. Pivoted Upper Sash, Double Hung, Pivoted Upper and Lower Sash.
Philadelphia, David Lupton's Sons Co., Allegheny Avenue and Tulip Street. Pivoted Upper Sash, Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted Sash, Double Hung, Casement, Stationary.
Philadelphia, The J. S. Thorn Co., 20th and Allegheny Avenue. Double Hung, Pivoted Upper Sash, Casement, Pivoted Upper and Lower, Fixed Upper and Pivoted Lower, Single Pivoted, Stationary.
Pittsburg, S. Keighley Metal Ceiling & Mfg. Co. Double Hung, Pivoted.
Pittsburg, Rasner & Dinger Co. Double Hung.
Salem, O., W. H. Mullins Co. Double Hung, Pivoted Upper Sash, Pivoted Lower Sash, Pivoted Upper and Lower Sash, Single Pivoted, Stationary.
San Antonio, Tex., T. P. Walsh. Double Hung.
San Francisco, Forderer Cornice Works, corner Potrero Avenue and 16th Street. Double Hung, Pivoted Upper Sash.
San Francisco, Rulofson Metal Window Works, 315-319 Monadnock Building. Double Hung.
San Francisco, San Francisco Cornice Co., Bryant between 9th and 10th Streets. Double Hung, Pivoted Upper.
St. Louis, Eagle Metal Works Co., 1510-1512 Clark Avenue. Double Hung.
St. Louis, Hopmann Cornice Co., 2571-2573 Benton Street. Double Hung.
St. Louis, Mesker & Bro., 421-519 S. Sixth Street. Pivoted Upper Sash, Pivoted Upper and Lower Sash, Single Pivoted, Double Hung, Stationary, Casement, Vertically Pivoted.

St. Louis, Powers & Boyd Cornice and Roofing Co., 3614-3616 Laclede Avenue. Double Hung.
St. Louis, John F. Ruth Cornice Works, 4298 Page Avenue. Double Hung.
St. Louis, Von Der Au & Cluss Mfg. Co., 2404-2408 South Jefferson Avenue. Double Hung.
St. Paul, St. Paul Roofing and Cornice Co. Double Hung.

WINDOWS, Hardware.

Sash Locks.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories' Inspectors have attached to each box of twelve locks, sealing the box, label reading as follows:



The following manufacturers are equipped to supply these devices:

Chicago, Payson Manufacturing Co., 1319 Jackson Boulevard.
New Haven, Conn., The H. B. Ives Co., 11-17 Artizan Street.

Sash Locks.

Malleable iron locks examined at factory and passed by Underwriters' Laboratories' Inspectors have attached to each box of three locks, sealing the box, label reading as follows:

The following manufacturer is equipped to supply these devices:
Philadelphia, Pa., Jas. Peters & Son, 1934-1938 North Front Street.

Sash Chains.

The following sash chain in sizes Nos. 80, 100, 130 and 250, has been examined and tested and is approved for use on metallic window frames and sash with wired glass as follows:

Size No. 80 for sash weighing not more than 90 pounds.
Size No. 100 for sash weighing not more than 120 pounds.
Size No. 130 for sash weighing not more than 160 pounds.
Size No. 250 for sash weighing not more than 210 pounds.

Community Guaranteed Sash Chain. Oneida Community Limited, Oneida, New York.

WIRED GLASS.

It has not been judged necessary to extend label service to this material up to the present time. Distinctive marks applied by the companies themselves to that portion of their product constructed in accordance with the standard (without constant supervision of such marking by the Laboratories) has been considered acceptable.

New York, N. Y. Mississippi Wire Glass Co.

This company claims exclusive right to the use of hexagonal mesh in wired glass. Decision of the Court of last resort on this claim is not yet obtained. In the meantime sub-standard wired glass using hexagonal mesh is occasionally found on the market. Members should therefore make careful inspection of this type of product before acceptance.

Philadelphia, Pa. Continuous Glass Press Co.

Marking: Consists of a strand of the wire mesh made by twisting two No. 27 gage wires together, and spacing such distinctive cabled strand approximately 10 inches apart in each sheet of glass manufactured.

Pittsburg, Pa. Arbogast-Brock Glass Co.

Marking: A U-shaped piece of wire, 3-16 of an inch in height, embedded near one corner or spaced about 15 inches apart vertically and horizontally in each light.

Streator, Ill. Western Glass Co.

Marking: Consists of five loops at each vertical strand of wire mesh.

Washington, Pa. Highland Glass Co.

Marking: Consists of a double strand of wire at intervals of 9½ inches. The two wires of the double strand are not twisted together except at the twisted portions of the mesh.

New York, N. Y. Mississippi Wire Glass Co., for American District Telegraph Co., 195 Broadway.

One-fourth inch wired glass with series of parallel wires about ½-inch apart, approximately midway between surfaces. Designed for use in connection with burglar alarm equipments. Submitted as possessing some value as fire retardant.

When mounted in standard window frames with lights not in excess of 720 square inches and with neither dimension in excess of 48 inches, this glass is approximately 50 per cent. as efficient as standard wired glass for protection against moderate exposure.

Woolen Mills---Fire Record.

Total Number of Fires, 750.

This class includes the following: Woolen Mills, 601 fires; Blanket Mills, 36 fires; Mixed Mills, 35 fires; Satinet Mills, 25 fires; Felt Mills, 24 fires; Yarn Mills, 19 fires; Wool Boot, 10 fires.

1. CLASSIFICATION OF CAUSES.

Common Causes.

LIGHTING. Number of fires, 23.
- Electric (arc or incandescent), 6 fires.
  - Short circuit of electric wire or lamp, 2 fires.
  - Employee sweeping lint from ceiling broke electric wires.
  - Lint on bare electrical connections.
  - Incandescent lamp burned out and set fire to fly.
  - Spark from open arc light falling into feed of card.
- Gas lighting, 3 fires.
  - Armful of stock brought in contact with open gas jet.
  - Spark dropped in mule head while lighting gas.
  - Gas jet set fire to Jacquard loom.
- Kerosene oil lamps, 7 fires.
  - Explosion of lamp, 3 fires.
  - Lamp overturned, 2 fires
  - Floating waste ignited by lamp.
  - Kerosene oil lighting.
- Kerosene oil lantern, 2 fires.
  - Handle of lantern used for lighting broke.
  - Employee working on mule spinner overturned lantern and ignited fly and oil soaked cotton belting inside.
- Open torch, 2 fires.
  - Employee using open torch ignited woodwork.
  - Employee cleaning out dryer using open torch, a chip of hardened oil fell into torch and ignited lint on floor.
- Safety lamp used for lighting dropped.
- Lighted match dropped on loom.
- Lighting, no data.

HEATING. Number of fires, 3.
- Stock against steam pipes, 3 fires.

POWER. Number of fires, 22.
- Hot bearings, 13 fires.

Shafting and clutches, 4 fires.
Friction or sparks from clutch, 2 fires.
Friction in counter-shaft.
Friction of wool around shaft which ran through wool room of picker house.
Belting, 2 fires.
Friction in belt enclosure.
Friction from belt.
Pulleys, 2 fires.
Friction of rim of pulley against wood casing.
Caused from idler pulley.
Fire started in or about water-wheel.
BOILER (or fuel). Number of fires, 17.
Overheated woodwork or combustible material, 6 fires.
Covering of steam pipe in contact with flue.
Defective flue from boiler.
Heat from boiler ignited cloth boards.
Heat from boiler ignited roof.
Heat from boiler stack ignited woodwork.
Overheated flue, too close to woodwork.
Sparks, 7 fires.
Sparks from brick stack came through cracks into card room and ignited flyings on ceiling.
Sparks from boiler furnace ignited woodwork in room.
Sparks from boiler furnace in fuel.
Sparks from boiler furnace ignited roof, 2 fires.
Caused by sparks, 2 fires.
Wool oil leaked on top of boiler.
Boiler furnace filled too full of refuse and damper closed which caused burning refuse to be blown out of boiler door.
Explosion of gases in economizer.
Boiler explosion.
RUBBISH (or sweepings). Number of fires, 4.
Spontaneous combustion of oily sweepings, 3 fires.
Spontaneous combustion of vegetable matter and rubbish under picker.
OILY MATERIAL. Number of fires, 3.
Spontaneous combustion of oily overalls.
Spontaneous combustion of oil and dirt in pulley box.
Spontaneous combustion of oily material.
SMOKING. Number of fires, 3.
Cigarette smoking, 2 fires.
Smoking, no data.
LIGHTNING. Number of fires, 8.
LOCOMOTIVE SPARKS. Number of fires, 2.
MISCELLANEOUS. Number of fires, 2.
Matches on floor, 2 fires.

Special Hazard Causes.

RAW STOCK. Number of fires, 18.
Spontaneous combustion of stock rolled up in burlap sheet.
Spontaneous combustion of mixed stock.
Spontaneous combustion of stock in gauze room.

Spontaneous combustion of wool waste.
Spontaneous combustion of rags in bags.
Started in batch of mixed stock which had been oiled and left in pile.
Wool on steam pipes, used for warming the wool before sorting.
Occurred in wet woolen waste.
No data stock fires, 10.

CARBONIZED STOCK DRYERS. Number of fires, 11.
Spontaneous combustion of goods in carbonizer.
Spontaneous combustion of lint near fan bearing in carbonizer.
Overheating of carbonizer.
Hot box on blower in dryer.
Ignition of stock in high temperature Sargeant dryer.
Stock on steam pipes.
Spontaneous combustion of dust in dryer.
Heat from carbonizer ignited woodwork.
Unknown in carbonizing machine, 2 fires.
Unknown in Kitson dryer.

SPONTANEOUS COMBUSTION OF CARBONIZED STOCK. Number of fires, 4.

DRYING. Number of fires, 132.
Stone dryer, 15 fires.
Table or screen dryer, 9 fires.
Sargeant dryer, 7 fires.
Cyclone dryer, 5 fires.
Cloth dryer, 2 fires.
Heathcote dryer, 2 fires.
Lorrimer dryer, 1 fire.
Dry rooms, 19 fires.
Dryers, no data, 72 fires.

SPONTANEOUS COMBUSTION OF DYED STOCK. Number of fires, 7.
Dyed cotton, 2 fires.
Spontaneous combustion of cotton dyed with logwood, sulphate of copper and cutch.
Spontaneous combustion of cotton dyed logwood black.
Dyed yarn, 2 fires.
Spontaneous combustion of dyed cotton yarn.
Spontaneous combustion of yarn stock.
Spontaneous combustion of dyed warp beams.
Spontaneous combustion of colored wool waste.
Spontaneous combustion of dyed woolen rags on floor near dryer.

CONVEYOR SYSTEMS. Number of fires, 6.
Foreign substance in stock passing through fan, 4 fires.
Foreign substance in blower-pipe.
Friction in fan and blower-pipe.

DUSTERS AND WILLOWS. Number of fires, 5.

PICKERS (including lumpers). Number of fires, 290.

GARNETTS. Number of fires, 3.

CARDING. Number of fires, 91.
Card fires, 89 fires.
Electric stop motion.
Spark from card grinder.

SPINNING. Number of fires, 6.
Mule spinning, 5 fires.
Mule head, 2 fires.
No data mule spinning, 3 fires.
Spark from electric stop motion.
SLASHING. Number of fires, 1.
Slasher exploded.
WEAVING. Number of fires, 1.
Unknown in weave room.
CLOTH FINISHING. Number of fires, 7.
Napping, 2 fires.
Hot journal on gig loom.
Hot bearing on napper set fire to flock.
Singeing, 2 fires.
Spark from singeing machine.
Singeing, yarn broke and ignited from lamp.
Foreign substance in smoothing machine caused spark.
Unknown in finishing room, 2 fires.
SULPHUR BLEACHING. Number of fires, 2.
Sulphur pot tipped over.
Blanket fell into sulphur pot.
WASTE MATERIAL (Spontaneous Combustion). Number of fires, 17.
Spontaneous combustion in waste house, 5 fires.
Spontaneous combustion in waste bin, 2 fires.
Spontaneous combustion of scoured waste.
Spontaneous combustion in barrel of waste.
Spontaneous combustion in basket of waste.
Spontaneous combustion in pile of picker room waste.
Spontaneous combustion in a bag of flock in card room.
Spontaneous combustion of lint in corner of spinning room.
Spontaneous combustion of waste, 2 fires.
Spontaneous combustion of waste from card, 2 fires.
MISCELLANEOUS. Number of fires, 9.
Spontaneous combustion of greasy burlap sheets, 2 fires.
Ignition of gasolene vapors in shed used for waterproofing woolens.
Cloth being cleaned with benzine, vapors ignited from friction.
Benzine used in washing machine ignited from friction caused by cloth running through rollers.
Sodium peroxide in contact with dye stuff.
Unknown in drug room.
Spark from forge, 2 fires.

Summary.

Common Causes.

	No. of Fires.	Per Cent. of Whole.
Lighting	23	3.3
Heating	3	.4
Power	22	3.2
Boiler (or fuel)	17	2.4

	No. of Fires.	Per Cent. of Whole.
Rubbish (or sweepings)	4	.6
Oily Material	3	.4
Smoking	3	.4
Lightning	8	1.1
Locomotive Sparks	2	.3
Miscellaneous	2	.3
Total	87	

Special Hazard Causes.

Raw Stock	18	2.6
Carbonized Stock Dryers	11	1.6
Spontaneous Combustion of Carbonized Stock	4	.6
Stock Drying	132	18.9
Spontaneous Combustion of Dyed Stock	7	1.0
Conveyor Systems	6	.9
Dusters and Willows	5	.7
Pickers (including lumpers)	290	41.6
Garnetts	3	.4
Carding	91	13.1
Spinning	6	.9
Slashing	1	.1
Weaving	1	.1
Cloth Finishing	7	1.0
Sulphur Bleaching	2	.3
Waste Material (spontaneous combustion)	17	2.4
Miscellaneous	9	1.3
Total	610	
Common Causes	87	12
Special Hazard Causes	610	88
Total	697	
Incendiary	4	
Exposure	4	
Unknown	45	
Total Woolen Mill Fires	750	

2. DETAILS OF CAUSES.

Common Causes

M-1387. About 45 minutes after the current was turned on the electric lighting system an incandescent lamp socket burned out in picker room. The flash set fire to the fly that had accumulated on the cord by which the lamp was suspended, setting fire to the burlap that formed part of the partition of the gauze room.

M-1420. During the evening the machinists were at work replacing a small overhead shaft which had broken during the afternoon. Several of the men were at work on the staging and one was holding a lantern. The handle of the lantern was defective and came out of the socket allowing lantern to fall on the floor. It struck near a spinning frame with considerable force, breaking the lantern and throwing kerosene about the floor. The kerosene ignited but was immediately extinguished.

S-3377. Sparks from open arc light falling into Bramwell feed of card ignited stock.

S-5373. When workman carelessly swept lint from ceiling he broke electric light wire, but it was not noticed as the insulating coverings did not break. Mill was operated in the evening and soon after power had been turned on workmen in room saw fire start at wires and promptly extinguished it with pails and wet brooms before it had a chance to spread.

Special Hazard Causes.

S-1087. Fire occurred in a rag stock dryer, wood enclosed, about 20x30 feet and six feet high, with a coarse wire netting screen about half way from floor on which carbonized rags are placed. Blower system of heating with blower and steam pipes outside at one end. Wood ventilating flue from enclosure to roof. Fire started inside dryer probably in stock itself. Fan spread fire out through wooden duct to monitor.

M-1332. Fire occurred in card room and was probably caused by a spark from emery wheel of a card grinder, on which four workers were being ground, setting fire to the fine lint which had settled on and around the grinder.

M-1364. At 5.45 p. m. fire was discovered in the carbonizer on the top floor of the carbonizing building. This fire was probably due to the heat from process in carbonizing. Fire consumed stock in process but was confined to machine.

M-1371. The carbonizer consisted of an iron frame, wooden panels covered with metal inside, metal lined, wooden top, and metal apron. There were no sprinklers inside carbonizer boxing. Fire originated in "white carbonizer" in attic of the picker building, cause unknown but probably due to the high temperature in the carbonizer. This carbonizer which is in operation all night having been stopped for the workmen's supper at about midnight was started again at 12.35 a. m. At about 1 o'clock a workman saw smoke coming out of the machine near the top. Burning through the woodwork at end of machine near feed bonnet which is but a few inches from the roof, the fire extended to the joisted roof which is boarded and shingled. The fire running over the dry woodwork and shingles burned the roof from three to six inches on each side of the ridge nearly the whole length of the building.

M-1392. At 9 p. m. fire occurred in drying room in picker building. The dryers were being run nights. Fire started in a pile of burlap sheets on top of dryer and near the box enclosing the steam coil,

probably being caused by the excessive heat from same. One sprinkler opened and fire was confined to the burlap sheets.

M-1411. During the noon hour a fire broke out in the white wool stock which was being dried on a table dryer. It was caused by the overheating of steam coils or friction at fan. One sprinkler opened and held the fire in check.

H-1449. Evidently during the Saturday afternoon and Sunday shut-down there was a leak of steam into slasher, which condensed, and consequently the large seven-foot drum was either full or partially full of water. The man in charge of the machine instead of testing his gauges in drawing off the water, forgot it, and turned on steam. He was unable to get more than four pounds pressure, and opened his valve full, so as to dry his yarn by putting in more steam. The result was that the slasher was wrecked, and bits of yarn went flying about the room, in which there were 40 people, but fortunately no one was hurt, though 50 panes of glass were broken out in front and behind the slasher. The three-inch shaft overhead was bent by the force of the explosion. The accident was caused by the neglect and carelessness of the man in charge in not doing what is constantly done, drawing off the water that condenses in the cylinder.

M-1471. At 6.30 a. m. a fire was discovered in mule room which was caused by a binder pulley on a mule becoming dry. Fire was confined to the mule.

M-1474. Fire occurred in card room caused by hot bearing on one of the cards. The heat set fire to strippings and flyings which were about the bearing.

M-1494. Shoddy was being blown from the mixer picker into a little side room. While going through the blowpipe a piece of metal or match in stock must have come in contact with fan and thrown spark into shoddy.

M-1495. At 6 p. m. fire was discovered on the wire bed of an open dryer among some scoured wool waste and burlap sheets. The cause of the fire was probably spontaneous combustion in a greasy burlap sheet which was rolled up and used as a partition to separate the different lots of wool waste.

M-1512. During the afternoon a fire started in the finishing room. Goods were in process and had been carbonized on Saturday but the acid had not been washed out of them. On Monday morning the foreman discovered that a fire was smouldering in the goods, probably caused by spontaneous combustion.

S-1733. Fire occurred in detached sulphur bleach room and was caused by brimstone pot. Pot set on two layers of brick on top of floor. Bricks probably disarranged by carelessness so that pot did not have a stable base. When red-hot iron was placed in the pot, which is used to melt and ignite brimstone, it overturned pot.

S-2611. Fire was caused by some foreign substance passing through picker. This was probably a nail as carpenters had been reflooring storehouse from which this lot was brought.

S-3468. Gauze room located between large picker room and lumper room and cut off from each by brick wall and iron fire doors.

Stock mixed in picker room, run through picker to gauze room, taken out on the other side and run through lumper to gauze room, then taken to lumper room and fed to stock blower system by hand. Fire started in lumper and was blown to gauze room where a slight explosion took place blowing off skylight. One sprinkler opened here. When either picker or lumper is running a slight air pressure is created in gauze room. This air finds egress through vents in room and also around the iron fire doors which have been warped by previous gauze room fires. Some of the burned stock in gauze room was blown through cracks around the iron fire door to picker room and set fire to the large pile of mixed stock near this door.

S-3872. Fire occurred in attic of mill occupied as dryer room. Probably spontaneous combustion in a Stone wool dryer.

S-4399. The operation of the circuit closer on the electric stop motion system is said to have caused a spark which set fire to the drawing or roving. Fire spread through three sets of cards. The current for the electric stop motion is generated by a very small dynamo and this current is probably at high enough voltage to cause a spark, assisted by the spark coil action of the electric magnets in circuit when the circuit is made and broken, that would ignite a drawing, especially with cotton in the mixture.

S-4615. This fire originated from spontaneous combustion in stock of dyed woolen rags on floor near dryer which was not in operation at the time and extended to woodwork of dryer.

S-4676. Fire started on the apron of a Sargeant dryer in which rags are baked after being subjected to acid. One high test sprinkler opened and practically extinguished fire. The fans however blew flame out end of dryer and set fire to roof, opening four sprinklers.

S-4722. The picker was running on a mixture of 80% cotton and 20% cotton waste. The picker is connected with a pressure blower blowing the stock to top story of wing. This room is divided into ten bins, tin-lined, with asphalt floors and sprinklers. At the time of fire, the stock was going into the southeast corner bin, which is 15 feet long, 10 feet wide, and 10 feet high.

A card hand stood near the door opening into his room and saw a flash coming out of the screened opening above the bin door. As he escaped into the card room, he saw the east wall of the mill fall outward. He does not remember seeing the door of the bin blown open, although as the latch was bent nearly at a right angle it is almost certain that this was done when the door was forced open by the explosion.

The 11-inch galvanized iron pipe through which the cotton was being delivered from the picker room into this bin was so arranged that the stock could be switched to other bins as required. There were two window openings in the east wall forming one side of this bin. One was boarded up except where the pipe entered, but the other one was a common wooden sash window, which was not disturbed by the explosion although there was sufficient force to blow out the wall beyond.

Judging from the stock remaining, the bin was nearly full and it is

possible that the inside of the wire screen above the door may have been coated with cotton so as to interfere with the free passage of air. The stock lay in a very light pile and probably the air above the pile was filled with flying particles of cotton and dust. It must also be remembered that this cotton and waste stock being handled had been slightly oiled in the picker room.

When the spark of fire entered the bin through the blowpipe it ignited this finely subdivided and inflammable material, the explosion followed, and the wall fell out.

S-5977. Fire was discovered by boss dyer in bed stock dryer. On opening the door of the room he saw a flame spring up out of the center of the bed and before he could extinguish it with a hand chemical extinguisher it had spread over the entire bed. Stock in dryer at time of fire was a wool clip stock of shoddy and cotton, probably 30% cotton. Stock had been treated with wool stock oil and red oil and then dyed a "Neutral Black A". Other chemicals used for setting dye are common salt, formaldehyde and bichromate of potash. The probability is that spontaneous combustion was due to these chemicals.

S-6363. Fire was undoubtedly due to some foreign material passing through fan. Stock passes from picker to gauze room, then is placed directly under vertical blowpipe, the end of which is about 1½ feet above the floor, and is drawn upward through fan and enters stock bins. Stock was being fed to system when men in stock bins saw fire drop out of blower pipe.

S-6557. Foreign material passing through lumper caused spark to ignite stock which in turn set fire to belt driving lumper. Fire travelled from lumper along its driving belt to main shaft where it struck the main belt driving three rag pickers 15 feet away on a counter-shaft. All belts were a total loss.

S-7746. At time of fire benzine was being used in a washing machine. Cloth going through rollers caused friction in some way and benzine ignited.

S-7945. Fire occurred at 11 a. m. in a rotary dryer in boiler house and was probably caused by friction and the fact that dryer had not been cleaned out for some little time.

3. ROOMS IN WHICH FIRE OCCURRED.

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Storage and Non-Manufacturing ..	10	13	15	3	10	24	35	5
Boiler Room.....	15	19	1	..	2	5	18	3
Engine Room.....	3	4	..	..	..	..	3	..
Wheel House.....	3	4	..	..	..	..	3	..
Belt Enclosures.....	1	1	..	..	..	..	1	..
Machine Room.....	2	3	..	..	1	2	3	..
Sorting Room.....	..	..	5	1	1	2	6	1

	Common Causes.		Special Hazards.		Unknown Incendiary Exposure.		Total No. of Fires.	
	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.	No. of Fires.	Per Cent.
Dusting and Willow Room	..	..	4	1	..	..	4	1
Carbonizing Room	..	..	11	2	..	..	11	2
Drying Room	1	1	124	21	2	5	127	18
Picker (including lumper rooms)	13	16	239	40	8	19	260	36
Gauze Room	2	3	64	11	1	2	67	9
Garnett Room	1	1	2	..	..	..	3	..
Carding Room	16	20	100	17	9	21	125	17
Spinning Room	5	6	5	1	..	..	10	1
Twisting Room (including slashing)	..	..	2	..	..	..	2	..
Weaving Room	2	3	1	..	3	7	6	1
Cloth Finishing Room (including singeing and napping)	3	4	9	2	2	5	14	2
Bleach House or Room	..	..	3	1	..	..	3	..
Waste House and Room	..	..	6	1	1	2	7	1
Miscellaneous Rooms	3	4	4	1	2	5	9	1
Total with data given	80		595		42		717	
No data	5		17		11		33	
Total	85		612		53		750	

Percentage not noted where less than 1%.

4. DAY OR NIGHT. (Day Fires 6 a. m. to 6 p. m.)

	Common Causes.		Special Hazards.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Day	46	57	481	82	20	40	547	77
Night	35	43	103	18	30	60	168	23
Total with data given	81		584		50		715	
No data	4		28		3		35	
Total	85		612		53		750	

5. PLANT IN OPERATION.

	Common Causes.		Special Hazards.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Plant in operation	33	72	314	84	10	37	357	80
Plant not in operation	13	28	61	16	17	63	91	20
Total with data given	46		375		27		448	
No data	39		237		26		302	
Total	85		612		53		750	

6. HOW DISCOVERED.

	Common Causes.		Special Hazards.		Unknown. Incendiary, Exposure		Total Fires.	
	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.	No.	Per Cent.
Employee	33	72	312	83	15	40	360	78
Watchman	7	15	47	12	14	38	68	15
Thermostat	..	..	2	1	1	3	3	1
Sprinkler Alarm.	1	2	5	1	..	..	6	1
Outsider	5	11	12	3	7	19	24	5
Total with data given	46		378		37		461	
No data	39		234		16		289	
Total	85		612		53		750	

SPRINKLER FIRE RECORD.

7. EFFECT OF SPRINKLERS.

	No. of Fires.	Per Cent. of Whole.
Extinguished or practically extinguished fire	428	71
Held fire in check	141	23
Unsatisfactory	35	5.8
Total	604	
No Claim	186	31
Small Loss	381	63
Large Loss	37	6.1
	604	

8. DETAILS OF UNSATISFACTORY SPRINKLER FIRES.

7905. September 30, 1891. Fire started at 8.10 p. m. in a card room on the third floor of the mill, caused by an exploding lamp. The

main mill was protected by Grinnell automatic sprinklers supplied by a tank of 1,650 gallons placed 10 or 12 feet above the sprinklers of the card room where the fire started. There were also two small fire pumps connected to the sprinklers. The sprinklers failed to check the fire, and it burned through the floor to the spinning room above, and got beyond the control of the mill apparatus, causing a loss of $85,507.

Summary: Light water supply.

7980. March 19, 1893. Fire occurred in the tentering drying room at 5.45 a. m., caused by a man at work cleaning out a drying machine. A chip of hardened oil was ignited by the flame of an open lamp, and set fire to the lint on the floor. The man was compelled to leave the chamber, and in so doing he neglected to close the door. Two watchmen and others were in the yard, but they could not reach a standpipe within 30 feet of the fire. The building where the fire started had only a partial sprinkler protection, and the fire extended to an adjoining building, where it was checked by five Gunn automatic sprinklers. Fire doors made by nailing flat sheets of tin on wooden doors, without locking or covering the edges, proved inefficient to resist the fire, as the heat followed the nails and prevented them from securely holding the tin. In one direction a standard tin-covered fire door kept the fire out of the adjoining building where there were $200,000 worth of goods, although there was some damage to these goods by water from four automatic sprinklers which were opened by the heat. The fire was extinguished in about two hours by streams from hydrants and from the town department. It was confined for the most part to the building where it started. Total loss, $75,000.

Summary: Incomplete sprinkler protection.

8115. May 13, 1893. Fire started in a card room at 2 p. m., the cause being unknown. This mill was equipped with Walworth automatic sprinklers, which opened properly, but it is supposed that something prevented the water from flowing from the tank to the sprinklers, as water was seen trickling out of the side of the tank while the mill was burning. This was after the main laterals of the sprinkler system were broken off, giving a capacity of discharge which would have prevented the pump from causing the tank to overflow. One of the check valves had a projecting arm, and it was found on examination that it did not operate at the time of the fire. The pump ran well, but it is evident that a large proportion of the water was wasted through the hydrants. The alarm was not sent to the adjoining town until about an hour from the time the fire started. The loss of the mill is considered to be due in the first place to the fact that the water could not flow from the tank to the sprinklers, and in the second place a large proportion of the water thrown from the pump was wasted. Loss $63,000.

Summary: Tank supply obstructed and pumps used on hydrants.

7997. June 14, 1893. Flyings on the steam pipe caused fire in a cloth dryer at 2.30 a. m. This dryer had been in use until 8.40 p. m. the previous day, and at 2 a. m. the watchman passed the dryer without noticing anything wrong. This dryer was cased in overhead and on one side, but between the casing and the machine on one side there was a narrow space. The inside of the dryer was not protected by

automatic sprinklers. The watchman discovered the fire. The city alarm was given promptly, and with the help of the other watchman and two laborers at work in the shed at the rear of the dye house a line of hose was laid to the fire. The fire, breaking through the casing around the dryer, opened 302 sprinklers in the room, of which 60 were Kane, six Hill, and the balance Grinnell sprinklers. Four streams were supplied by the mill pumps and six or eight later by the city fire department. Loss $55,559.

Summary: Unsprinklered portions.

7908. August 17, 1893. The main mill was discovered to be on fire at 12.20 a. m., by a woman living in the neighborhood. The watchman is said to have been in the card room, where the fire started, at about midnight and reported all right. The watch clock was burned with its dial. Both pumps were started and threw good streams until the floors fell and broke off the pipes. Several men reported that they saw the sprinklers in operation during the early stages of the fire. There is no reason given why they did not hold the fire in check. The fire soon disabled the protective apparatus, and everything combustible was burned. The stone walls were left standing but were badly damaged. All of the wooden detached buildings in the mill yard were saved. Loss $66,614.45.

Summary: Not classified.

8169. November 16, 1893. A hot bearing on an upright shaft caused a fire at 12.05 p. m. The location of this fire was such that the automatic sprinklers could not discharge any water upon it. The fire extended upward and downward on the shaftway through all stories of the mill, and also penetrated the hollow spaces between the sheathing and the outside boarding. The automatic sprinklers opened, retarding the rapidity of the fire to some extent. Eight streams were used on the fire from the mill pumps and the steam fire engine. The floors were flooded, and stood until their bearings in the hollow walls at the sides were burned away, when one floor fell upon that below. If it had not been for the hollow spaces in the walls, the owners consider that the mill could have been saved with but very little loss. Loss, $70,149.

Summary: Floor openings and concealed space.

8173. Uxbridge, Mass. November 6. 1894. Fire occurred at midnight, starting in an outside open shed in which there were no sprinklers, and located between the main (wooden) mill and the picker house. It was caused by the spontaneous combustion of rags in bags. The fire was discovered by the watchman. Finding he could not control it, he opened the tower door to get at the bell rope, but was driven back by the smoke. He then went to the house of the owner and gave the alarm. It was probably fifteen minutes from the discovery of the fire before a hose stream was applied, and in the meantime the fire spread rapidly over the upper part of the mill, comprising the card and spinning rooms, which, with their contents, were totally destroyed. About 75 Grinnell automatic sprinklers opened, and three hose streams were used, and the fire was extinguished after a duration of five hours.

In the rooms below there was no fire loss, though a number of sprinklers opened, and the whole was thoroughly drenched.

After the apparatus was in operation, the fire appears to have been judiciously handled. The noticeable features are the failure of the watchman to discover the fire earlier, and the fact of the complete burning of the upper part of a large wooden building with plank floors and sides, with no fire loss to the lower part. The sprinklers appear to have opened promptly, but as the fire had acquired much headway before getting inside the mill, they could not extinguish it. Loss, $10,000 to $20,000.

Summary: Exposure fire.

8170. Lawrence, Mass. February 9, 1895. Fire occurred in the waste room of mill at 7 p. m., probably caused by spontaneous combustion of stock on dryer. The fire spread rapidly over the whole room. The room was formerly used for storage and kept cold, so that the water was shut off from the sprinklers. Lately, stock-drying machines using hot air had been put in, warming the room and increasing the hazard, but through inadvertence the water had not been let on the sprinklers. The fire was extinguished by hose streams from steamers and mill hydrants, after burning about half an hour. Loss, $5,000 to $7,500.

Summary: Water shut off.

7998. Trenton, N. J. September 24, 1895. Fire occurred at 7.40 p. m., caused by the spontaneous ignition of wool extract shoddy in the small frame storehouse. It communicated very quickly to the brick sorting building. The frame building may have been well on fire inside before the fire was discovered, which would account for its rapid spread. The fire was discovered by parties outside, who notified the watchman, and the public alarm was at once sounded. Fifteen hose streams were used on the fire, three by the mill help and twelve by the city fire department. The automatic sprinklers in the yarn winding room opened, but the fire was beyond sprinkler control when it reached them. The frame storehouse and the sorting building and shed adjoining were destroyed. The fire lasted three hours. With better protective appliances the loss on the brick sorting building might have been materially reduced. Loss, $95,000.

Summary: Exposure.

8171. Woonsocket, R. I. September 28, 1895. Fire occurred at 8.45 a. m. in the brick dye house, dry house, and picker house, and the wood stock house, caused by foreign substance in the stock. The mixing picker was in the dye house, which was not sprinklered, and the fire started in this. The stock going through at the time was a lot of a little over 2,000 pounds, which was 70% wool and 30% cotton. The fire spread over this rapidly.

The superintendent was in the dye house at the time and sent another man to strike the public alarm. He tried to put a stream on the fire from two of the yard hydrants, but found the pressure very deficient.

The engineer states that he started the pump promptly, but he was under instructions to keep the gate on the discharge pipe closed unless

he received other orders, and he did so, the consequence being that the only use made of the pump was by hose streams off the pump itself. The help, after trying two streams off the outside hydrants, both of which failed to give efficient service, tried one off the pump and soon burst the hose. The public department tried streams off the city hydrants and found them weak, and later took streams off the pump and got four streams from it. Two steamers were called, and both of them were used until one of them broke down by accident to one of the flues.

The hydrants which the superintendent attempted to use are connected with the pump, and had the full capacity of the pump been turned on to them at least two good streams could have been obtained from them. When the city department found the public pressure deficient they managed to get at the valve in the dye house controlling the supply to the sprinklers and shut it off, after which they stated that the public mains gave good streams.

It is evident that the mill help did not understand how to make the best use of the equipment, and before any effective work was done on this fire it had spread through the dye house and dry house and to the wooden stock house. The apparatus at these works, while not excellent, must nevertheless be rated as good. The construction was excellent. The pump was a 1,000-gallon Underwriter 20x11½x15 inches, capable of throwing at least five good streams, but the discharge gate being closed the pump could be of no service except to provide hose streams from the pump itself. This is clearly a case where the lack of proper organization of the mill help proved disastrous.

The fire lasted three hours and destroyed stock house and nearly destroyed No. 4 group. Loss, $130,000 to $160,000.

Summary: Unsprinklered portions.

7270. Sutton, Mass. October 19, 1896. Fire was first seen coming through holes from engine room to card room and probably started in engine or boiler room. Undoubtedly incendiary. Risk was equipped with Walworth sprinklers placed pendant, wet system, gravity tank supply, giving about ten pounds pressure. Second supply two rotary pumps. Gravity tank soon exhausted and rotary pumps could not be started owing to some disarrangement of the starting gears.

Summary: Defective water supplies.

7405. Hampton, Mass. December 1, 1897. Fire discovered by watchman at 2.30 a. m. and alarm given by blowing mill whistle. Fire was on first floor of picker house building, used for drying wool stock, being located two feet from main building. Room of open mill construction. This room contained a wool stock dryer with about 400 pounds of dyed and scoured wool stock. Cause of fire unknown. Fire was fought by sprinklers with pump and mill hose and was under control when pump failed on account of wool from storehouse dropping into head race and stopping wheel; then pails were used. Sprinklers were Grinnell pendant, old style, spaced eight by nine and one-half feet. Eight in room and all opened. Pipe sizes, 1895 standard. Wet system with tank and pump supply. Pressure on sprinklers before opening, about 40 or 45 pounds. Sprinklers appeared to have very little effect on the fire. Stock house was 12 feet from picker building,

not sprinklered, and was connected to same and main building by wooden platform on level of second floor. There were unprotected windows and doors in end of picker building exposing stock house. Stock house immediately took fire and burned rapidly. Men confined their efforts to picker house and main building. One head opened in dye house and held fire in check at this point. Stock house and contents were entirely destroyed and picker building practically total loss except walls. Main building and dye house slightly damaged. There was no sprinkler alarm and fire occurring during watchman's rounds probably gained considerable headway before being discovered. Loss, about $10,000.

Summary: Incomplete sprinkler protection.

7442. Belmont Road, Pa. January 26, 1898. Watchman discovered fire about 6 a. m. in the one-story building, southwest of main mill and adjoining, used for storage of shoddy in bags. Fire appears to have started among this woolen shoddy; cause not definitely known but evidently from spontaneous combustion. This building was of stone, open-joist ceiling, wooden floor and contained one willow and main line shafting. Risk was equipped with Walworth single linked sprinklers, placed pendant. Old standard spacing and arrangement; wet system, supplied by a 10,000 gallon gravity tank, giving about 19 pounds pressure, and a Worthington Duplex fire pump. Watchman blew whistle on discovering fire and private brigade responded promptly. Fire pump was immediately started but shortly after a four-inch coupling on the four-inch sprinkler main in this building became disconnected and so reduced the pressure on the hose that sprinkler line from pump had to be shut off, leaving gravity tank the only supply, which was quickly exhausted. Said coupling was examined and found to have been screwed on the pipe only three threads. Pipe was well supported. The wall between No. 3 building and main mill is blank at first floor with windows on second and third floors of main mill over No. 3 building. These windows were not protected. On the roof of No. 3 and alongside of wall of main mill was a corrugated iron belt box with a studding frame work. Fire followed this and worked through shaft into second and third floors of the main mill. Heat and smoke also passed through shafting and pipe holes into buildings Nos. 4 and 5, adjoining No. 3. Twenty sprinklers opened in all. Examination of sprinklers of No. 4 showed that five of these were tied shut by strings, the assured having a fire only two days before and did not have enough links to replace the sprinklers opened. Other sprinklers were found badly clogged with scale or sediment. This in connection with the breaking of the four-inch coupling on sprinklered main allowed the fire to get beyond control.

Summary: Generally defective equipment.

174. Milton Mills, N. H. September 11, 1898. Main mill was 110x55 feet; wood, brick lined, plank and timber floors, open finish. Basement and two-story brick picker house adjoining, also one-story wood dye house. Boiler and engine house adjoined tower No. 5 from mill. Fire was discovered by outsiders at about 1.30 a. m. on Sunday and alarm was immediately given by watchman by ringing bell at mill.

Fire was first noticed in card room on first floor of main mill, in upper story of boiler house and in space between the two buildings. Cause probably incendiary. There was a complete system of Walworth heads, wet system, which had just been installed. Piping was of standard spacing and arrangement with primary supply of 10,000-gallon gravity tank, 500-gallon steam and 750-gallon rotary pump. As water-wheels were started from card room, rotary pump could not be used. The steam pump was started immediately and two or three hydrant streams used from same. Hydrant streams were of little value, as, owing to smoke, boiler room could not be entered and steam in boilers was quickly exhausted. Main mill and additions were practically a total loss. Pump supply was not used on sprinklers, post gate in yard being kept closed.

Watch records of that night show that watchman went his rounds as required. Examination of gravity tank showed that water should have been properly discharged to sprinklers as gate valve under tank was found open and draw-off valve was found closed. System was probably put out of commission by incendiary.

Summary: Incendiary fire.

261. North Andover, Mass. December 21, 1898. Fire occurred at 6.25 a. m. just as mill was about to start up. It was discovered by one of the employees, starting at south end of card room and spread up through ceiling to rooms above, being aided by spouts or wool chutes. Fire spread into sheathing and practically entire roof was burned off, including top floor of mill and cock loft. Mill was of open mill construction except roof, which was gable, boarded on joist and sheathed. Cause of fire is unknown.

Mill was thoroughly equipped with Esty sprinklers, old standard spacing and pipe sizes. Wet system; primary supply, gravity tank eight feet above sprinklers that opened. Second supply from 500-gallon Underwriters steam pump and 450-gallon rotary pump. Apparently, a large number of sprinklers opened very soon after fire was discovered. Pumps were immediately started and pressure was put on sprinklers and maintained until piping broke in top story when sprinklers were shut off and pumps used for hose streams. Fire department responded and assisted in extinguishing fire. Sprinklers evidently aided in stopping spread of fire, especially in card room where fire was confined to a small part of south end.

Summary: Generally defective equipment with light water pressure.

291. Pascoag, R. I. January 21, 1899. Risk consisted of a two-story wooden mill, and addition to main mill basement and two-story high. A small detached boiler house was connected to main mill by a covered wood belt box. Floors and roofs were plank on timber, open finish throughout. Buildings were situated very close to each other. Main mill, addition and boiler house were equipped with Grinnell and Walworth automatic sprinklers. Spacing of sprinklers mostly new standard, pipe sizes old standard. There were about 24 Walworth sprinklers in lumper picker room, basement of addition, where fire started. These were placed pendant. Primary supply for sprinklers

was a 6,000-gallon gravity tank, located in top of tower. Second supply, 400-gallon rotary pump, which also supplied four old style hydrants.

Fire was discovered by watchman at neighboring risk who immediately gave alarm by ringing the mill bell. Cause of fire unknown. The water-wheel was immediately started and an attempt was made to throw the rotary fire pump into gear, but owing to smoke and heat owner was driven out of building. There was no fire department protection. Fire spread rapidly throughout building, opening a large number of sprinklers and gravity tank was soon exhausted.

Summary: Defective water supply.

534. Burrillville, R. I. May 5, 1899. Fire was discovered at 1.25 a. m. by watchman, in attic story of mill No. 2, near stair tower. Cause of fire unknown. Plant had been idle about nine months and was undergoing repairs preparatory to starting up. No. 2 mill was of stone, three and one-half stories high, open plank and timber construction. No. 1 mill adjoined No. 2 and was cut off on first and second floors by stone walls and fire doors, and on third floor by blank stone wall. Mill No. 1 and 2, and addition thereto, also storehouse No. 6 and second and third stories of boiler house building, were equipped with Grinnell glass disc sprinklers, wet system, primary supply 5,200-gallon gravity tank giving 10 pounds pressure on sprinklers where fire started. Second supply 500-gallon Underwriters steam pump and two rotary pumps. These were connected to sprinklers and hydrants. Sprinklers were spaced 8x10 feet in eight-foot bays. Pipe sizes, old standard. Pumps were immediately started and used on sprinkler system and hydrants. Fire spread very rapidly under light gravity tank pressure before pumps were started and was finally controlled by hose streams. The sprinklers, however, did excellent work and assisted materially in holding the fire in check, it being confined almost wholly to the third story and attic of No. 2 mill and upper stories of stair tower. Fire did not spread to other portion of risk owing to good cut-off walls and fire doors.

This fire again illustrates the necessity of a good heavy pressure primary water supply to sprinkler system and undoubtedly had this been the case, fire would have been controlled in its incipiency.

Summary: Defective water supply.

642. Millbury, Mass. October 30, 1899. Watchman discovered fire at about 12.30 a. m. either in the weave room or cloth room. Cause unknown, probably incendiary. The weave room is on the first floor of main mill and the cloth room first floor of addition. Addition was on the east side of the main mill and was of mill construction, while the old mill was of joist construction. Fire spread rapidly throughout mill, opening a large number of sprinklers. Mill was equipped with Walworth sprinklers, wet system, old standard pipe sizes and arrangement, supplied by gravity tank on trestle in yard, a rotary and a small steam pump. Upon discovering fire, watchman aroused engineer and immediately started rotary pump which was used on sprinkler system until roof collapsed breaking sprinkler pipe, then all the pressure was put on the hydrants. Steam pump could not be started owing to the flames

and smoke. Watchman tried fire alarm box, both going and coming from the superintendent's house, but the box had recently been painted and he was unable to open it, necessitating sending in alarm from a station nearly one-half mile from risk, delaying fire department considerably. Owing to the rapidity with which fire spread, under light gravity tank pressure, fire was soon beyond control and risk was practically destroyed.

Summary: Defective water supplies.

1649. Burrillville, R. I. November 29, 1901. Country woolen mill, stone walls, plank and timber floors. Fire occurred in room used for wet and dry finishing. Cause unknown. Risk was equipped with Grinnell glass disc sprinklers, standard spacing and arrangement, part old and part new standard pipe sizes, supplied by gravity tank giving about 24 pounds pressure on sprinklers. Second supply consisted of a rotary pump in wheel house and an Underwriters pump in boiler house at opposite end of mill. It is stated that an attempt was made to start steam pump but that smoke had entered boiler room so that this supply was useless. Fire door to boiler room was found open in the ruins. Rotary pump in wheel house was also rendered useless by reason of dense smoke. Fire had evidently been burning for some time before discovered by the watchman. It is stated that sprinklers operated but as mill was entirely destroyed, no reason could be given for the failure of the sprinklers to control fire in its incipiency.

Summary: Not classified.

1946. Glenside Station, N. Y. September 12, 1902. Fire occurred at 12.10 a. m., just as the watchman was entering the card room, the mill being in operation. Probable cause, foreign substance in stock passing through card, stock was low grade wool and cotton at time of fire. Building of open joist construction, with stone walls. Card room ceiling had been covered by oiled canvas nailed to the joists back of the sprinklers to prevent any leakage from roof getting on the cards. Building was equipped with William Kane sprinklers; piping and spacing old standard, supplied by gravity tank 30 pounds pressure and rotary steam pump. Eighty-four sprinklers opened and assisted in controlling the fire. Fire got into canvas sheathing at ceiling of card room and roof was entirely destroyed. Pumps were started about 15 minutes after fire occurred, but as steam pump had too great a draught, it was difficult to maintain good pressure. Rotary pump leaked badly at time of fire and pump service was very insufficient. The automatic fire door to weave room operated satisfactorily but there was an old pipe hole near door and heat passing through this opened one sprinkler. The fire doors between card room, storage and spinning building adjoining were not automatic, and two sprinkler heads opened at this point holding the fire in check. The sprinkler heads were old and probably slow to operate. This in connection with old standard pipe sizes and spacing allowed fire to spread into concealed space. Loss, approximately, $20,000.

Summary: Generally defective equipment.

2701. Millbury, Mass. January 6, 1904. Fire occurred in room over boiler and engine room, probably caused by charring of wood

floor over boiler. Wood trussed construction; room used for dusting at times. Fire discovered by watchman who immediately gave alarm by ringing mill bell. Risk was equipped with Walworth pendant sprinklers, modern spacing and arrangement, standard pipe sizes; supplied by gravity tank. Sprinklers failed to control fire and it is probable that tank supply pipe was frozen, allowing very little, if any, water to pass through the sprinklers.

Summary: System crippled due to freezing.

2800. Conway, Mass. March 6, 1904. Fire occurred between 5 and 6 a. m., supposedly in the machine room at the north end of first floor of a frame and stone constructed mill, which was practically destroyed with the exception of brick storehouse, cotton warehouse and frame storehouse north and south of main buildings. Watchman passed through machine room on his last round at about 5.20 and did not notice anything unusual. Fire was discovered by outsider at about 6.15.

Risk was only partly equipped with Grinnell glass disc sprinklers, supplied by 2,900-gallon gravity tank resting on attic floor and a 300-gallon rotary pump. Rotary pump was out of service as the valve in suction had frozen and split.

Machine room, where fire occurred, and room above were not equipped with sprinklers and fire spread very rapidly, getting beyond control of the sprinklers where installed.

Summary: Unsprinklered portions.

2984. Hampden, Mass. April 11, 1904. Full process woolen mill, country risk; frame mill construction, totally destroyed by fire. Fire occurred at 12.15 a. m., discovered by the watchman; cause unknown. Risk was equipped with Grinnell glass disc sprinklers supplied by private reservoir, 25,000 gallons, through four-inch pipe giving 70 pounds pressure on sprinklers. This reservoir was drained during the fire. Second supply consisted of rotary pump but this was poorly located and owing to smoke could not be started, the pump and wheel being started from inside only. It is not known positively that the sprinklers operated, but reservoir was full five days before the fire and valves were found open after the fire. It is possible that fire may have been well under way before being discovered by the watchman and it was at least twenty minutes before any help arrived at the mill and the reservoir was drained by this time. Fire started near an open stair tower which aided the rapid spread. It also came out the basement windows and ran up the outside of building and may have gotten in behind the wood sheathing on side walls. Fire was poorly handled and there was no outside protection that could be used due to the poor location of pump. Mill practically a total loss.

Summary: Not classified.

2999. Tilton, N. H. April 19, 1904. Fire started at about 12.40 a. m., in a three-story addition, mill construction, used for drying stock. Caused probably by spontaneous combustion in dyed cotton stock on the dryer which had a few minutes before been turned over and exposed to the air. Risk was equipped with Esty sprinklers, modern equipment, wet system, primary supply from town water, giving 90

pounds pressure on the sprinklers. Second supply was rotary pump. Sprinklers failed to hold fire in check in the dry room but extinguished fire at east and west ends where it broke through into main mill. The fact that sprinklers did not control fire better is undoubtedly accounted for by the fact that some of these sprinklers were high test and there was considerable corrosion, although many corroded heads had recently been replaced. For further details, see Bulletin No. 7, Page 28, October, 1904.

Summary: High test sprinkler heads.

3259. Philadelphia, Pa. September 19, 1904. Brick mill, open joist ceilings. Fire occurred in screen dryer, cause unknown. Risk was equipped with Walworth old style sprinklers; two heads in dry room, both of which opened. The only water supply was from a 3,500-gallon gravity tank giving 15 pounds pressure on the sprinklers which opened. Sprinklers failed to extinguish fire due to fire burning between joists where water from sprinklers could not protect same owing to the light pressure. Fire had begun to work through ceiling which was thin and full of holes into the unsprinklered room above when fire department arrived and extinguished same. Sprinklers were probably high test and slow in operating; this with the light water pressure allowed fire to get beyond control.

Summary: Defective equipment.

8172. South Royalston, Mass. October 25, 1904. At 10.45 a. m. fire was discovered in the gauze room of picker building, where it had evidently been blown from the rag picker. The picker building was frame construction and occupied in one story by the rag pickers, this room being sprinklered. The rooms above and below were occupied for miscellaneous storage and by flumes and wheels, and were not equipped with sprinklers. The fire immediately burst out from the gauze room with great violence, spread over the picker room and from there throughout the rest of the building, completely destroying the same. There were eleven automatic sprinklers in the picker room, but from some cause unknown they did not hold the fire. The building was old and probably the floors were badly oil soaked, which would account for the rapid spread of the fire to the stories above where there were no sprinklers. Two lines of hose were immediately carried to the roof of the main mill and streams directed on the picker house. These streams were used in this way throughout the fire. A third stream was taken along the ground and played into the front of the picker house.

At the start the wind was light and from the northwest. The fire burned quickly and fiercely. The covered bridge across the river became ignited, and although the town hand engine worked on it, the bridge was burned sufficiently to fall into the river and become a total loss. About thirty minutes after the fire started, the wind shifted to the southwest and rapidly increased in force. The mill brigade continued their work at the position stated. The tower on the main mill is of wood with shingled roof. The paint on the easterly wall was scorched from the effect of heat, but the use of the hose stream prevented it from taking fire. When the wind shifted, burning embers

set fire to a church 350 feet northeast of the picker house and it was completely destroyed. A large wooden schoolhouse adjacent took fire from the church and was also practically destroyed. A number of houses from 300 to 500 feet beyond the church and the schoolhouse were ignited by brands and some damage done to roofs, and a store near the church was considerably burned.

During all this time, the cornice sprinklers on main mill were working and the easterly wall of the mill shows no evidence of fire at any point except that the southerly window in the top story has several panes of cracked glass. The picker house was practically destroyed in about one hour.

It is evident that the cornice sprinklers did good work although they were not taxed very severely as the wind was away from the main mill. Loss estimated $8,000 to $12,000.

Summary: Partial sprinkler equipment.

3390. Philadelphia, Pa. December 2, 1904. Fire occurred on first floor used for carding and spinning and spread to floors above. Open mill construction. Risk was equipped with Walworth soldered deflector sprinklers, 65 on a floor. Heads ten feet apart, in nine and one-half foot bays, wet system. Water supply, city water, 85 pounds, four-inch connection from six-inch city main through meter. Fire started at licker-in and quickly spread to loose stock of cotton on floor and in process. Employees immediately turned in alarm from near-by street box and tried to fight fire with standpipe stream but the heat soon became so intense and the smoke so dense that they were driven from the building, probably leaving water running from standpipe. Fire department arrived within ten minutes and two additional alarms were immediately sent in.

The firemen state positively that the sprinkler system was in operation and that sprinklers on first floor continued to operate all day. Fire was extinguished on the first floor but continued to burn on the second floor, spreading to the third. From the appearance of the second and third floors, it seems that fire spread to floors above through cracks in the planking igniting stock and woodwork. This caused the opening of a large number of sprinklers, thus drawing upon the supply so heavily that the pressure in the system was so reduced that it was ineffective, especially on the upper floors. On the third and portions of the second, where fire was apparently the hottest, there was no water in the pipes at all as many of the heads were completely melted off. Fire was confined to building in which it started. It is evident that the water supply to sprinklers was materially reduced by the employees using the two-inch hose supplied by a four-inch sprinkler connection being driven away by the heat and leaving this two-inch stream running to waste. The fact that five streams and several hose streams direct from hydrant were draining from the six-inch main, which was the only supply for the sprinklers, readily accounts for the failure of the sprinklers to hold fire on the upper floors. The Walworth soldered sprinkler heads were also probably slow in operation and several were found unopened, with the deflector unsoldered, in portions where heat must have been intense.

Summary: Generally defective equipment.

3729. Huntington, Mass. April 12, 1905. Frame country mill. Sprinklers supplied by the town water, 60 pounds pressure, steamer and pump supplies. Fire was probably of incendiary origin and seems to have started in several places at once in the sheathing at walls. Fire was at night and watchman failed to discover it. Sprinklers were controlled by outside post indicator valve and this had been closed and the wrench thrown away. This shut off all water supplies to sprinklers and risk was totally destroyed.

Summary: Water shut off.

4521. North Dexter, Me. October 30, 1905. Fire started in picker room and spread into blind space between ceiling of picker room and roof. This blind space was not sprinklered. Fire was finally controlled by private hose stream. This shows the undesirability of concealed space not equipped with sprinklers.

Summary: Concealed space.

4604. Coventry, R. I. January 12, 1906. Frame country woolen mill. Fire occurred at 7.15 p. m., mill not in operation. Watchman discovered fire, cause of which is unknown. Building was equipped with Grinnell glass disc sprinklers, dry system, old standard spacing and pipe sizes. Sprinklers supplied by gravity tank 7,500 gallons capacity, giving about 27 pounds pressure in room where fire started. Sprinklers and dry valve operated properly. Fire started in picker room basement of No. 1 mill, open mill construction. It may have been burning sometime before being discovered and in any event spread from picker room to stair tower. Sprinklers in stair tower were shut off in cold weather which was the case at this time. Fire spread up this tower and was soon beyond control. Rotary pump, second supply to sprinklers, was being repaired at the time of fire and plant was entirely destroyed.

Summary: Defective sprinkler equipment.

4883. Philadelphia, Pa. May 19, 1906. Fire occurred on second floor of picker building, brick, joist construction, probably starting in a pile of shoddy wool stock. Risk was equipped with Walworth ordinary sprinklers, old standard spacing, the primary supply being a 5,000-gallon gravity tank, and second supply a 500-gallon steam pump. Twenty-six sprinklers opened. Fire spread so rapidly that it soon ignited the roof joist and roof was badly damaged. The unsatisfactory work of the sprinklers probably due to old style equipment and light water pressure. Steam pump was used but watchman opened wrong valve and filled the tank instead of pumping direct into the sprinklers.

Summary: Defective equipment with light water pressure.

6214. Spencer, Mass. October 4, 1907. Fire started over the top of a Heathcote dryer in the first floor of addition and spread through unprotected doors and belt holes to floor above. In all 220 sprinklers were opened and fire was finally controlled by the fire department. Risk was equipped with Walworth sprinklers of various types supplied by waterworks giving 100 pounds pressure. Wet system. The sprinklers in the dryer and also some in that vicinity were high test and at least two were wired closed. Furthermore, five

of the sprinklers were of the Walworth upright pattern placed pendant. The most probable cause of the failure seems to have been the failure of the high test heads and those wired closed so that fire was allowed to obtain considerable headway. Floor openings also played an important part in the spread of the fire.

Summary: Defective sprinklers. (Part high test.)

6220. Harrisville, R. I. December 19, 1907. Fire started in yarn dryer in one-story frame dye house building. Cause unknown. This dryer was equipped with Grinnell glass disc sprinklers, 360°. Good water supply. Fire broke out of dryer and spread to stock bins and thence into attic of adjoining building. It was finally controlled by hose streams. Investigation showed that three of the four heads in the dryer were blocked up with small stones so that only one discharged water to any extent. This allowed fire to get considerable headway before the sprinklers outside could be of any service.

Summary: Sprinklers clogged.

8032. Sherbrooke, Canada. October 12, 1908. Fire occurred in wheel house, frame joisted construction, and was caused by hot bearing. There were four sprinklers in the room which opened, but they were of no effect as the sprinkler piping was clogged with small pieces of wood. Fire was finally controlled by hose streams.

Summary: Sprinkler pipes clogged.

8185. Unionville, Conn. February 21, 1909. Fire occurred on first floor in shipping room, mill construction. It occurred at night and there was no regular watchman. Cause is unknown. Risk was equipped with Grinnell glass disc sprinklers, but the old and generally defective system, supplied by waterworks 60 pounds pressure. Fire probably spread considerably before being discovered and owing to poor pipe sizes and spacing a large number of sprinklers opened overtaxing the water supply. Loss about $45,000.

Summary: Generally defective equipment.

9. DETAILS OF LARGE LOSS SPRINKLER FIRES. (Where sprinkler control is satisfactory.)

M. February 21, 1891. Fire was caused at 6.45 a. m. by the dropping of a safety lamp used for lighting up. The alarm was sounded and the department responded. Fire was extinguished by 16 Kane automatic sprinklers and streams from mill apparatus and fire department. Most of the damage was due to water from the streams of the fire department. Loss, approximately, $9,000.

Summary: Not classified.

M. June 7, 1893. Watchman discovered fire in the four-story picker building at 11.50 p. m., caused probably by spontaneous ignition of dirt in a covering around the pulley. Watchman supposed that he had extinguished the fire by the use of fire pails, when he found that there was a fire in the story above. He then gave the alarm. Forty-four Walworth automatic sprinklers opened and held fire in check aided by the use of fire pails and hose stream from city fire department, fire having extended through the three stories above. The watchman had left many of the fire doors open in the wall between the picker

building and the mill and firemen found it necessary to concentrate their efforts at this point to keep fire from entering the mill. The southerly side of picker building was made of board covered by corrugated iron and fire rapidly passed from one story to another through the space afforded by these corrugations. Loss approximately, $5,000.

Summary: Concealed space.

1019. Killingly, Conn. June 18, 1900. At 8.30 p. m., fire started in the Bramwell feed or first breaker in a set of Cleveland cards and was discovered by owner who was in dye house. Owner immediately gave alarm by blowing the whistle and watchman got out two hose streams. Pump was started and run nearly an hour, discharging water into sprinkler system and hose stream. Old standard equipment Grinnell issue D sprinklers. Wet system supplied by town water, 22 pounds pressure and pump. Every sprinkler in the card room opened, 35 in all, and seven in weave room and entry opened from heat. Card clothing and all belting in card room was a total loss, most of the damage being from water. Watchman passed through card room on his 8 o'clock round and states that everything appeared to be all right at that time. Watchman failed to discover fire. Loss, approximately, $12,000.

Summary: Card room fire.

3872. Skowhegan, Me. May 10, 1905. Fire occurred at 1.15 p. m. in attic of Mill No. 1 in dryer room. Caused by spontaneous combustion in a Stone wool dryer. Sprinklers were Walworth and Grinnell glass disc; 78 in attic and five in dryer; all opened. Modern spacing and arrangement, wet system, supplied by city water, 80 pounds, and steam pump in mill. Pressure held at 80 pounds. Sprinklers held fire in check with a loss of approximately $27,000.

Summary: Not classified.

4777. Pittsfield, Me. March 6, 1906. Fire was discovered by employee in card room at 5 a. m. Mill in operation. Walls of room were lathed and plastered, ceiling open joist, and was used for carding and spinning. Fire was probably caused by spark from electric circuit-closing device, controlling an automatic stopping arrangement. Employee standing near card saw a blue flame shoot out, probably from this device, and then saw that card was on fire. He tried to extinguish fire with pail but found that it was impossible. There were eight men working in room. One ran and gave alarm and others used hose from standpipe in tower. There were four sets of cards, fire starting on second breaker next to finisher, flashed at once over all, making a quick, hot fire. Sprinklers were Grinnell pendant, installed with pipes in 1899; pipe sizes, 1895 standard; supplied by town waterworks, 72 pounds pressure on sprinklers before opening. Seven sprinklers opened and held fire in check. Fire gave off a very dense black smoke so that employees could not see fire and consequently probably used much more water than was actually needed. Stock was a mixture of cotton shoddy and wool, 30 to 40% cotton. Loss, about $10,000.

Summary: Card room fire.

5082. Philadelphia, Pa. May 18, 1906. Watchman discovered

fire in picker house at 1.15 a. m. It evidently started among nests of sparrows, close under roof and above the sprinklers. Sprinklers were wet system, supplied by gravity tank about 25 pounds pressure; Walworth pattern 1888 sprinklers. Forty-seven opened. Sprinklers were spaced 8x9 feet and owing to obstruction from rafters, and so forth, did not properly cover the roof. Loss, $11,000.

Summary: Poor spacing and arrangement.

5372. Philadelphia, Pa. August 31, 1906. Fire occurred on fourth floor, evidently in a bearing box. Floors of double plank and timber with truss roof and boards on joist. The main belt drive was well enclosed here but evidently very dirty and fire spread rapidly to floor above and thence to mules. Bearing box had a sprinklered head in it which immediately opened and prevented spread of fire on fourth floor, but rapidly revolving pulleys carried fire to fifth floor. Twenty-six Walworth sprinklers opened and practically extinguished fire. Old standard pipe sizes, wet system. Primary water supply, gravity tank, with a pressure of 12 pounds on sprinklers that operated. Fire department was summoned but fire was out upon their arrival. Mule carriages on this floor were practically destroyed and cards and stock on all floors below were badly damaged from water. Loss, $15,000.

Summary: Floor opening.

10. POINTS OF INTEREST FROM FIRE REPORTS.

Alarm Service.

S-158. In the afternoon bells on thermostat system connected to superintendent's and employee's house began to ring. Superintendent and employee went to mill at once and found that fire had started in picker room of attic of main mill. Two sprinklers had opened and extinguished fire.

S-2006. One sprinkler head opened and extinguished fire. Ether tube thermostat two feet further away from fire than sprinkler failed to operate. It is thought that water ran for nearly an hour before discovery by outsider.

S-2150. Fire occurred at 5.50 a. m. Clock records show watchman reported at station near the place where fire originated at 2 a. m. only.

S-2163. Watchman made last round at 5 a. m. and was at boilers when fire occurred at 6 a. m. The sprinkler alarm had been disconnected for some time. Had this been in order it is probable that watchman would have known of fire in time to save considerable damage. Fire discovered by employee on coming to work.

S-2176. There was no sprinkler alarm on equipment. Fire occurred between watchman's rounds and he did not know of fire until after sprinklers had extinguished it.

S-2731. Alarm valve had been placed on line from tank a week or two before fire but had not been connected to gongs so that sprinkler alarm did not operate.

Automatic Sprinklers.

S-2150. Fire occurred in lumper and picker rooms opening 24 heads extinguishing the fire. Thirteen heads opened in card room because of the fact that fire door only partly closed allowing heat to pass through, but fire did not communicate to card room. City fire department responded by sending a hose wagon because of impassable roads.

S-2163. A particular point of interest is the poor work of the old Grey sprinkler heads. Out of 15 removed after the fire six had failed to open, due to sticking of fibre disc and partly from sediment in heads. There were three heads still in the pipes out of which thimbles fell but which failed to operate. Three other heads still should have operated, one having evidently been subjected to very severe heat. It is possible that others failed to open at time of fire although it is evident a few did.

S-3243. Eleven sprinklers opened and extinguished the fire. At the time there was in the picker room 10,000 pounds of stock, of which 4,000 pounds was open on the floor. This stock was 60% wool, 30% wool waste and 10% cotton and was of course of a slow burning kind, but the quickness and the decisiveness of the sprinkler action was worthy of note.

S-4456. The fire started apparently near the bearing of cylinder of second breaker card. It was seen first near the feed rolls in the stock which had already passed through the first breaker card. The fire quickly traveled over the sliver to the finisher card, and also back to the creel of the second card.

Although the amount of fuel was not great, being only the stock on these two cards and creel, there was probably enough heat liberated to open ordinary sprinkler heads. The three heads nearest the fire (directly over it) were removed, and two were found to be 286° and being pendant were badly clogged with sediment. They also had at some time been painted with white lead and afterward cleaned off.

S-7100. The sprinklers in the dry room were 286° on the old Parmelee spacing, about 12 feet apart. From the burned condition of the dryer and the joisted ceiling it is apparent that the sprinklers in the dryer were of slight assistance in preventing the spread of fire. The sprinklers examined showed considerable sediment in the head.

S-7945. Five heads inside the dryer opened and controlled the fire, confining it to the machine. No sprinklers were opened in the room itself.

Fire Doors.

S-2396. A fair automatic sliding fire door separates the picker and stock rooms, but this door was prevented from entirely closing by stock piled in door opening.

Floor Openings.

S-6153. Fire started in picker and was blown into gauze room. Metal blower pipe in gauze room extended to attic of main mill through ceiling of gauze room. Fire spread through a slight space around pipe to attic and ignited stock in bags.

Hose.

S-7099. Fire occurred in stock bin in picker room. Employee used a line of 2¼-inch hose and was driving the flames back from the bin when the hose burst. Before another length had been secured fire had spread to other bins.

Obstruction to Distribution.

S-4121. Two sprinklers held fire in check over dryer, but fan box obstructed distribution and fire burned through floor above opening one sprinkler.

S-4319. Sprinklers were located above dryer screen which was covered with silk noils at time of fire. This prevented water from sprinklers reaching the fire. Hose streams were used to extinguish same.

S-6153. Water from sprinklers could not reach the blaze in the bales of stock in picker room, fire being mostly on under side of bales. Fire also traveled along the joist channels where water from sprinklers was obstructed.

Unsprinklered Portions.

S-3809. Fire worked through stock conveyor from picker to gauze room which is of fire resistive construction and not sprinklered. There was some stock in gauze room and fire burned itself out, practically destroying all the stock therein.

Water Shut Off.

M-1396. As the picker house was only partially heated it was customary to keep the water shut off sprinklers in cold weather. Watchman discovered the fire at 8 p. m. bursting from the windows of the duster room in the second story of picker house. He immediately gave the alarm and opened gate valve so that tank water could reach the sprinklers, and also started up a small pump for an additional supply. Twenty-five sprinklers opened and two hose streams were used, confining the fire to the room, the roof however being badly burned.

Water Supplies.

S-4226. Rotary pump had been removed and sent away for repairs so that gravity tank was the only supply to sprinklers. Power pump, however, was started immediately and used to fill tank.

11. NUMBER OF SPRINKLERS OPENED.

No. of Sprinklers Operating.	Extinguished Fire. No. of fires.	Extinguished Fire. Per cent.	Held Fire in Check. No. of fires.	Held Fire in Check. Per cent.	Unsatisfactory. No. of fires.	Total. No. of fires.	Total. Per cent.	No. of Sprinklers Operating.	No. of fires.	Per cent. of whole.
1	80	19	16	11	..	96	16	1	96	16
2	84	20	14	10	1	99	17	2 or less	195	33
3	44	11	14	10	..	58	10	3 or less	253	43
4	41	10	12	9	3	56	10	4 or less	309	53
5	26	6	12	9	..	38	6	5 or less	347	59
6 to 9 inc.	85	20	21	15	..	106	18	Less than 10	453	77
10 to 24 inc.	45	11	29	21	2	76	13	Less than 25	529	90
25 to 49 inc.	7	2	20	14	1	28	5	Less than 50	557	95
50 and over	3	1	2	1	24	29	5	50 and over	29	5
Total	415		140		31	586				

Average number of sprinklers opened not including unsatisfactory, 7.4.

12. ALARM SERVICE.

	Satisfactory. No. of Fires.	Satisfactory. Per Cent.	Failure. No. of Fires.	Failure. Per Cent.	Total.
Watchman alone	39	100	..	..	39
Sprinkler alarm alone.....	4	100	..	..	3
Thermostat alone	2	66	1	33	3

	Watchman. Satisfactory.	Watchman. Failure.	Sprinkler Alarm. Satisfactory.	Sprinkler Alarm. Failure.	Thermostat. Satisfactory.	Thermostat. Failure.	Total.
Watchman and Sprinkler Alarm	5	..	5	..	..	..	5

Note.—These tables do not include fires where alarm service does or does not operate properly if fire is at once discovered by employee, the alarm service having no bearing on such fires one way or the other.

13. SECONDARY WATER SUPPLY.

1019. Primary supply, waterworks, 18 pounds pressure. Secondary supply, steam pump. Forty-two sprinklers opened and pump was run for nearly an hour, pumping water into sprinkler system and hose streams.

3872. Primary supply, city water, 80 pounds pressure. Secondary supply, steam pump. Eighty-three sprinklers opened and pump was used to hold pressure at 80 pounds.

4413. Primary supply 400-gallon automatic steam pump. Secondary supply 1,000-gallon Underwriters steam pump. Thirty-nine sprinklers opened and secondary supply used to maintain heavy pressure on sprinklers.

4498. Primary supply, gravity tank, 16 pounds pressure. Secondary supply, rotary pump. Thirteen sprinklers opened and were in service about half an hour. Rotary pump used to maintain good pressure and supply.

4833. Primary supply, gravity tank, 16 pounds pressure. Secondary supply, rotary pump. Thirteen sprinklers opened. Rotary pump not started until gravity tank was about half empty. Pump then maintained good pressure on sprinklers extinguishing fire.

5082. Primary supply, gravity tank, 25 pounds pressure. Secondary supply, fire pump. Forty-seven sprinklers opened owing to obstruction to distribution and pump was of service in holding up the pressure.

5345. Primary supply, gravity tank, 13 pounds pressure. Secondary supply, rotary pump. Forty-three sprinklers opened almost at once. Rotary pump was of great value in maintaining good pressure and volume.

5959. Primary supply, gravity tank, six pounds pressure. Secondary supply, rotary pumps. Pumps supplied good pressure to sprinklers, 46 of which opened.

6363. Primary supply, gravity tank, 12 pounds pressure. Secondary supply, rotary pump. Forty-seven sprinklers opened and pump was used to supply sprinkler system and hose streams.

6765. Primary supply, waterworks, 96 pounds pressure. Secondary supply, 1,000-gallon steam pump. Thirty-eight sprinklers opened and pump was started at once supplementing the waterworks supply.

14. EFFICIENCY OF WATER SUPPLIES.

Primary Water Supply.	Number of fires	Per cent. of fires	Average Pressure	Average number Spkrs. opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Water works,	261	68	75	7.8	72	26	2	75	77	74	6.3	12.3
Gravity tank,	98	25	22	9.0	62	27	11	23	19	27	6.9	13.5
Pressure tank,	9	2	94	5.3	100			94			5.3	
Automatic pump,	18	5	70	5.3	67	33		65	81		3.6	8.7
Total,	386		62	7.9	70	26	4	63	62	40	6.3	12.5

15. EFFICIENCY OF WATER PRESSURES.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average Pressure	Average number Spkrs. opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened. Extinguished fire (or practically extinguished)	Held fire in check
Less than 15 lbs.,	23	6	10	13.1	52	35	13	12	9	9	11.1	16.1
15 to 24 lbs. inclusive,	48	12	19	8.6	69	25	6	18	19	18	6.0	15.7
25 to 49 lbs. inclusive,	67	17	35	8.8	70	24	6	36	32	32	6.6	15.1
50 lbs. and over,	248	64	83	7.2	72	25	2	82	85	73	5.9	10.8
Total,	386		62	7.9	70	26	4	63	62	40	6.3	12.5

16. EFFICIENCY OF WET OR DRY SYSTEM.

Wet or Dry System.	Number of fires	Per cent. of fires	Average Pressure	Average number Spkrs. opened	Per Cent. of Fires. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Pressure. Extinguished fire (or practically extinguished)	Held fire in check	Unsatisfactory	Average Number Sprinklers Opened Extinguished fire (or practically extinguished)	Held fire in check
Wet system,	343	89	63	6.7	70	26	4	64	62	42	5.4	10.2
Dry system,	43	11	59	17.5	72	26	2	60	60	27	12.8	30.7
Total,	386		62	7.9	70	26	4	63	62	40	6.3	12.5

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

17. EFFICIENCY OF WATER SUPPLIES. As Regards Amount of Loss.

Primary Water Supply.	Number of fires	Per cent. of fires	Average Pressure	Av. No. Spkrs. opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Water works,	261	68	75	7.8	32	65	3	74	76	72	3.5	9.4	44.0
Gravity tank,	98	25	22	9.0	18	72	10	24	21	25	6.0	9.0	36.5
Pressure tank,	9	2	94	5.3	22	78		90	95		2.5	6.1	
Automatic pump,	18	5	70	5.3	44	56		68	72		2.8	7.3	
Total,	386		62	7.9	29	67	4	66	62	45	3.8	9.1	41.0

18. EFFICIENCY OF WATER PRESSURES. As Regards Amount of Loss.

Pressure on Sprinklers.	Number of fires	Per cent. of fires	Average Pressure	Av. No. Spkrs. opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Less than 15 lbs.,	23	6	10	13.1	9	78	13	11	11	8	22.5	11.1	24.0
15 to 24 lbs, inclusive,	48	12	19	8.6	35	58	6	18	19	19	3.6	10.5	42.0
25 to 49 lbs. inclusive,	67	17	35	8.8	21	75	4	37	35	27	4.4	9.6	25.0
50 lbs. and over,	248	64	83	7.2	31	66	3	83	83	75	3.3	8.6	45.0
Total,	386		62	7.9	29	67	4	66	62	45	3.8	9.1	41.0

19. EFFICIENCY OF WET OR DRY SYSTEM. As Regards Amount of Loss.

Wet or Dry System.	Number of fires	Per cent. of fires	Average Pressure	Av. No. Spkrs. opened	Per Cent. of Fires.			Average Pressure.			Average Number Sprinklers Opened.		
					No claim	Small loss	Large loss	No claim	Small loss	Large loss	No claim	Small loss	Large loss
Wet system,	343	89	63	6.7	28	67	5	67	62	46	3.6	7.3	41.0
Dry system,	43	11	59	17.5	35	63	2	60	60	27	5.3	24.3	
Total,	386		62	7.9	29	67	4	66	62	45	3.8	9.1	41.0

Note—"Average number of sprinklers opened" does not in any case include the Unsatisfactory fires.

General Fire Record.

UNSATISFACTORY OR SERIOUS FIRES IN RISKS EQUIPPED WITH SPRINKLERS.

8432. South Boston, Mass. March 15, 1909. Cotton Waste Mill. Fire occurred at 8.15 a. m., while plant was in operation, on first floor of brick building with open joist construction. Fire discovered by employee who turned in public alarm. Department responded and extinguished fire. The operation of sprinklers was not satisfactory, pipe sizes being 1, 3, 6 and worse. The floors were full of cracks and otherwise poorly constructed and the stock inflammable and the fire spread immediately up to the third floor. Eight sprinklers opened on the first floor—four on the second and five on the third, but fire department was compelled to throw considerable water. Loss $5,000, due principally to water.

Summary: Defective equipment.

8438. Montreal, Que. March 18, 1909. Oil Cloth Factory. Fire started at 3.30 p. m. in building used for cork grinding; brick and stone walls; mill floors. Two by five-inch plank on edge with one-inch hardwood top floor; roof two by four-inch plank on edge, with frame sheathed finish, metal clad roof house, over part. Building equipped with dry system and Grinnell straightway valve. Sprinklers, Esty No. 5, installed 1908. Spaced 10x10 feet on sheathed ceiling; 6x8 feet across joists, staggered eight feet in ten-foot bays, mill ceilings; centre or side central feed. Sprinklers on dry valve, 230; 36 on second floor, 24 in roof house all opened. Pipe sizes 1905 standard. Air pressure at time of fire 30 pounds. City water supply; static pressure on sprinklers that operated 40 to 50 pounds. Fire extinguished by fire department, three hose streams and hand chemicals.

This is the third fire reported in this building since it started operation last fall; but is the only one on which a claim has been made. All have started in the grinders on the first floor; but the resulting action in each case has been different.

There are four grinders on the first floor. Each consists of a pair of stones enclosed in a steel case. The cork is fed to the grinders from an open wood hopper, 23x4 2-3x3 feet, on the second floor, through four enclosed wooden chutes, each about 6x4 inches wide, terminating in iron hoods over the grinders. There are wooden chutes and screw conveyors enclosed in wood, from hopper, and the cork dressing machines at and near hopper, to cork bin in roof house.

There was said to have been an explosion in one of the grinders; but there is no evidence of fire on this floor or in the wooden chute from grinder to hopper on second floor. The first evidence of fire is on the

inside of hopper on second floor, above the level of the cork, the hopper being nearly full of stock at the time.

A small wooden cork dressing machine stood on hopper and a large one about five feet away. Large one was metal lined in part, and sprinklered (four heads). The fire practically destroyed the small dresser and ran up sides of wooden enclosed conveyors. The hopper is close to side of building and windows were open at the time, with a breeze blowing in. The heat from such a fire is said to be great; and ceiling of second floor caught fire over the hopper. This ceiling is two by four-inch plank on edge; but its continuity is broken slightly where the roof house sets—that is, ceiling on each side of where roof house begins is raised three to four inches. A small hole has been cut in this ceiling opening into roof house, with a light board cover. By means of this opening and probably also by the outside of some of the chutes, fire was communicated to roof house.

Roof house was 40x20 feet in size, frame, metal clad, and wood sheathed at ceiling and walls, except for a small inclined section inside of house proper having an open joist ceiling. There were about 24 heads in this roof house, which was used as a cork bin, and all opened but failed to control fire, which evidently got in the concealed space back of the sheathing and practically destroyed the roof house. Part of sprinkler pipes fell.

There were 32 sprinklers on the second floor and four in the large cork dressing machine, and all opened. The ceiling is charred over four of the sprinklers. The heads on this floor are said to have held fire.

The dry valve is reported as operating slowly; but no definite statement could be obtained as to length of time, and it may be that it only seemed long to those waiting for the water to come after the heads opened.

The absence of any evidence of fire from the grinders to the top of hopper, a distance of approximately 12 to 14 feet, can only be accounted for by the explosion lifting the stock in the chute and hopper, and the flame setting fire to the hopper at the top, while the stock, settling back in the hopper and chute, smothered any fire here.

The open sprinklers were replaced, some temporarily with hard heads, and system is in service today.

It is probable that the roof house will be rebuilt of tile.

The nearest city hydrant was found frozen. It was also frozen at the fire in January.

Cause of fire probably a piece of metal in grinder; or the striking of grinding stones. Loss about $2,500.

Summary: Unsatisfactory work of sprinklers in roof house probably due to sheath finish. Sprinklers helped to hold fire in check on second floor.

8437. Cambridge, Mass. March 22, 1909. Rubber Factory. At the time this fire occurred man in charge had just finished boiling a batch of rubber cement, and was removing it from the kettle in which it is made to small storage cans kept outside the building.

This cement is made of blown corn oil (a non-hazardous oil), rosin and shoddy rubber; the proportions are not known to us. No naphtha or other volatile substance is used. The mixture is put into an iron kettle holding about 120 gallons, which rests on a brick arch or furnace, and boiled for about four and one-half hours, after which the kettle is lifted

by a crane to the floor and the contents dipped out by hand into metal cans holding about 20 gallons each and placed outside to cool.

During the process of boiling, the temperature reaches probably 500° F. and dense steam-like fumes are given off in large quantity. These fumes are removed by a flue opening into a metal hood which covers the kettle.

The following test, twice repeated, in a New York State Oil Tester was made of the cement:

At ordinary temperatures the substance is almost a solid and quite sticky.

At 140° F. it was viscous.
At 190° F. it was like heavy cylinder oil.
At 386° F. it first flashed.
At 460° F. it burned readily.

From 460° F. on up the fumes popped and flashed around a burning taper and at about 500° fire would travel back through the smoke and steam from a distance of two feet to the main mass. There was nothing of an explosive nature—just a flash. This was probably due to the hydro-carbon gases given off, which are inflammable.

Manufacturers have no idea how the fire occurred. They have been making this cement for years and have never had any trouble with it. A kettle full of the cement had just been removed from the furnace and stood about ten feet away from the open fire. Employee says that just as he took out a dipperful of the cement to pour it into a small can it burst into flame and flashed over it into the big kettle. The most probable explanation seems to be that a sudden gust of wind blew through the open doors striking the smoke in such a manner that, instead of going up the flue as ordinarily it would, it came in contact with the live coals and flashed back. It is also possible that the hot fumes ignited spontaneously as this tendency was noted to some extent during above tests. The hands of the man at work were burned considerably. Manufacturer says smoking is never done here.

The six sprinklers in the room opened but the water only served to overflow the kettle and spread the fire. Fire doors communicating to the other rooms were closed and fire was confined to the one room. It destroyed the electric light wiring, the batch of cement and a little rosin, sulphur, and so forth, which happened to be near-by, before the fire department arrived and put it out with the chemical. Two wire-glass windows were destroyed by firemen. Total loss about $700.

Summary: Severe hazard. Water from sprinklers on blazing liquid spread fire.

8433. Wilmington, N. C. April 3, 1909. Saw and Planing Mill. Fire started at 2.10 p. m. while plant was in operation, in battery of dry kilns, frame joisted construction, composition roof. Cause unknown. Foreman of planing works gave alarm by blowing whistle. Building equipped with sprinklers installed 1895. In the kiln in which fire occurred 47 opened out of a total of 62. Sprinklers did good work but were at a disadvantage as seven heads were out of commission in kiln where fire originated and draft through the same was unusual. Six sprinkler heads were afterwards found plugged with lead. Sprin-

klers were assisted by private hydrants and brigade and public fire department, fire boat and steam jets. Loss, $7,000.

Summary: Sprinkler heads out of commission and distribution of water obstructed by lumber.

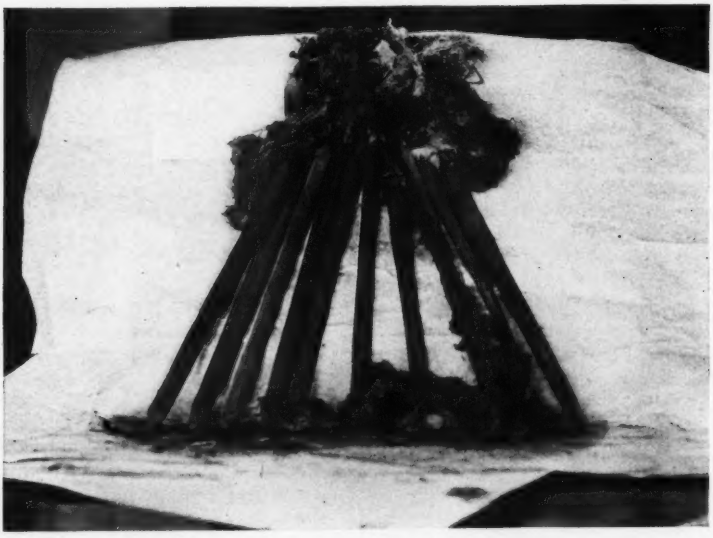
8436. St. Louis, Mo. April 8, 1909. Woodworker. Group of six factory buildings and lumber piles practically destroyed by fire starting at 5.30 p. m.

The plant was protected with a standard dry-pipe automatic sprinkler equipment, consisting of four five-inch systems, located in

Sprinkler Fire No. 8436.
Steamer connection plugged with wood.

building "A". This equipment was installed in 1898. Two of the systems were provided with Hibbard differential dry pipe valves and two systems were provided with Niagara dry-pipe valves. The greatest number of sprinklers on any floor of factory, the building in which fire originated, was 512. The sprinkler heads covered an area of 64 square feet each and were staggered.

At the time the sprinkler equipment was installed, Hibbard sprin-



Sprinkler Fire No. 8436.
Wooden spindles, rags and waste removed from steamer connection.

kler heads were used. These were replaced in 1907 with approved Niagara sprinkler heads.

The equipment was supplied by two six-inch city connections, taken from six-inch and twelve-inch city mains, pressure 80 pounds, a 17,800-gallon gravity tank, 20 feet above roof of the highest building, and four steamer connections. The alarm of the equipment was extended to nearest engine house, one block distant.

The fire apparently started in the north end of the basement of the factory. The sprinkler alarm operated, but the fire flashed through the building so quickly that the engineer states that although he attempted to go into the factory when the sprinkler bell rang, he was unable to do so, on account of the smoke and fire.

Examination of the street valves in city mains during the progress of the fire show that these valves had been closed before the fire started. The fire department pumped a great deal of water into the building, and as soon as basement was relieved of water examination of automatic valves and steam connections was made. Automatic valves were found to be open. The valve of gravity tank was found to be open and sealed. One of the steamer connections, however, was found to have been removed, and a large wooden plug forced into the pipe and steamer connection replaced. The other three steamer connections were blocked tightly with rags and the tank apparently had been drained.

There can be no doubt but that the sprinklers would have controlled the fire in the basement if tank had been filled with water, as

the elevation of the tank above basement was sufficient to have given the sprinklers in basement 26 pounds pressure.

From the rapidity with which the fire spread, and the condition in which the sprinkler equipment had been placed, it is apparent that the fire was of incendiary origin.

Loss, about $300,000.

Summary: Crippled sprinkler equipment—probably incendiary.

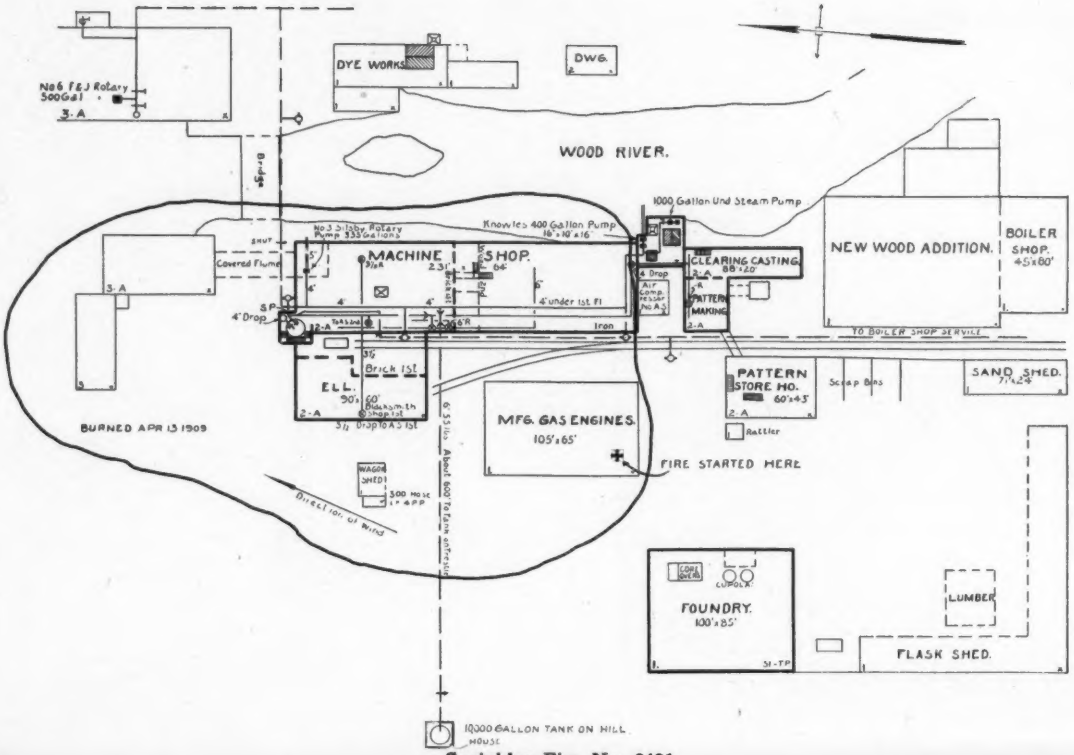
8440. Lisbon, N. H. April 9, 1909. Woodworking Plant. Fire started between 8.20 and 8.50 a. m. in either second or third compartment from lower end of large frame, joist construction dry kiln and was first seen by a yard man. Alarm was given on mill whistle.

As near as could be learned, two streams were in use and fire pump started between five and ten minutes after fire was discovered. Town department responded and in all eight streams were in use, two of which were from hydrants in street. Pressure at pump was maintained at 60 pounds until private reservoir was exhausted. It was said all streams were giving good service until fire pump was stopped. Inspector could not learn just how long pump was in use, but probably somewhat less than an hour. It was said dry kiln was practically destroyed before pump stopped, but near-by lumber shed and storehouse caught fire and burned after pump stopped. Sprinklers apparently had little or no effect in stopping spread of fire. There were ten compartments all filled with lumber, piled in usual way, with about an inch space between each layer of boards and boards not piled close together; this gave fire a good chance to burn and obstructed water from sprinklers. Attic of kiln was entirely open, low studded and one area with probably 180-212° sprinklers, these probably all opened at about the same time which greatly reduced pressure on sprinklers in kilns Post indicator valve to these sprinklers was closed as soon as pump was stopped. Fire was not under control until afternoon and streams were played on fire all night. Shortly after fire started, a storm of wet snow fell, which, with the help of a large bucket brigade and only a moderate wind, very likely prevented the destruction of the whole plant, as fire gained headway after pump stopped. Dry kiln is completely destroyed and near-by storehouse and shed practically destroyed, and about 100,000 feet of lumber in yard burned. Dry kiln was heated by hot air; blowers being located at north and south ends of building. Failure of sprinklers was probably due to high test heads (286° where fire started), obstruction to distribution by lumber, and blower system spreading the fire rapidly and opening a large number of sprinklers.

Sprinklers, Grinnell glass disc 286° in kilns and 212° in attic. Installed 1908. Pipe sizes 1, 2, 3, standard spacing. Sprinkler alarm valve, English, connected to water rotary gong; operated. Cause of fire unknown.

Summary: Insufficient water supply and interference with water distribution by piles of lumber.

8431. Hope Valley, R. I. April 13, 1909. Machine Works. Fire was discovered at 12.15 p. m. in detached one-story, frame gas engine



Sprinkler Fire No. 8431.

building. This building was located about 40 feet west of brick machine shop and 45 feet south of brick ell to machine shop.

It was about 100x65 feet and was used for manufacturing and testing of gas engines although owner stated that no testing had been done on the day of the fire. There were, however, three men and a boy working in this building and they went to dinner at 12 o'clock. At about 12.15 workmen eating their dinner in machine shop discovered fire and state that building was a mass of flames at that time. They rang the bell in the tower, which served as a village fire alarm. In a short time many of the village people were on the scene, and a stream was soon taken from the hydrant at the south end of machine shop, another stream was taken from hydrant near the machine shop tower and both steam pumps started. The 400-gallon single pump was apparently used throughout the fire, although the packing blew out soon after starting. It is probable that the 1,000-gallon pump broke down shortly after it was started, owing to breaking of the rocker pin. It was probably three-quarters of an hour before this was repaired. Rotary pump at the plant was out of commission, owing to the fact that new gears were being installed for water-wheels. The pump at a mill across the river was started and one stream was taken from near-by hydrant.

Owner stated that tank on hill was full, but it seems probable that it was not more than one-half full when fire started. There was a strong wind blowing, estimated at 30 miles an hour, and this blew the fire directly toward the brick machine shop. Window casings and boxed cornice soon took fire and fire was blown through the building. Sprinklers apparently opened satisfactorily but were greatly handicapped by the strong wind. It is probable that many sprinklers were quickly opened and that the tank supply did not last long. The pump supply was entirely inadequate to feed both sprinklers and hydrants, and as a result, the machine shop was soon doomed.

The two and one-half story frame mill across the river caught fire and tower was partly burned but the private hose streams together with open sprinklers on peak of roof prevented further damage. The pump at this plant was a Fales & Jenks No. 6 (500-gallon) rotary and did good service. The open sprinklers were Grinnell automatic type with struts removed.

The cause of the fire is not known but was undoubtedly connected with the gasolene hazard. Had the gas engine building been sprinklered the results would probably have been different.

The failure of the sprinkler system is probably due to the following causes:

1. Fire starting in an unsprinklered section.
2. Heavy wind.
3. Deficient water supplies.

Were it not for the heavy wind the fire might have been confined to the unsprinklered building where it started.

Sprinklers were installed 1897 and 1898. Wet system. Spacing standard, part staggered under joisted construction. Pipe sizes 1, 2, 4. Portion not sprinklered, clock room at tower on machine shop; scale room and driveway at machine shop; toilets; one-story frame addition

used for air compressor. Detached buildings, including boiler shop; foundry, pattern storehouse, flask shed, wagon shed, and so forth.

Water supplies, 10,000-gallon gravity tank on hill 600 feet distant and 120 feet above highest sprinklers; 1,000-gallon Underwriter steam pump connected to system through four-inch pipe, Knowles single steam pump 400 gallons capacity. Silsby Rotary Pump No. 3 about 300 gallons capacity.

Three private non-frostproof hydrants in yard poorly located near buildings and supplied by pumps, also six-inch connection with 500-gallon rotary pump at the mill across river, about 100 feet distant. Post valve in this six-inch pipe located close to machine shop building.

Loss, $200,000.

Summary: Incomplete sprinkler protection.

8441. Philadelphia, Pa. April 24, 1909. Knitting Mill. This fire was confined to two adjoining buildings No. 2 and No. 4, brick, five-story, 140x45 feet and 64x50 feet respectively, plank and timber construction, open ceilings, wooden trussed roofs, covered with tin.

Floors three-inch plank with one-inch flooring, on 12x8-inch timbers extending, continuously, from wall to wall and supported at the center by 9x9-inch wooden columns, not superimposed; span 21 to 22 feet, bays eight feet, no drainage.

Floor Openings. A continuous belt drive from first to fifth floors, poorly frame enclosed in part in building No. 4. Floors around belt somewhat oil-soaked. Frame enclosed, auto-trapped elevator and stair tower enclosed by brick walls and poorly cut off at north of building No. 4.

Fire Divisions. A brick wall separates buildings No. 2 and No. 4. A doorway communicates on each floor except fifth where wall is blank. Single, tin-clad fire doors protect these openings. A large belt hole through fire door on fourth floor, two smaller belt holes on third floor and large belt hole on second floor, all practically unprotected, allowed these buildings to communicate quite freely. Also windows in south wall of No. 2 and east wall of No. 4 are located about every nine feet to corner, distance between windows, facing in corner, being three to five feet.

Sprinkler Equipment. Installed in 1894. J. Kane "Universal" sprinklers. 1896 standard pipe sizes supplied by 10,000-gallon gravity tank, ten feet above top lines, and by 750-gallon steam pump (Worthington duplex, Underwriters 16x9x12 inches). No steamer connection.

Third floor building No. 4, 17 bays, one line sprinklers in bay, ten feet on a line, equals total on floor, 65.

Fourth floor building No. 4, 17 bays, one line sprinklers in bay, ten feet on a line, equals total on floor, 65.

Fifth floor building No. 4, 8½ bays, three lines of sprinklers lengthwise of building, eight and nine feet on a line, equals total on floor, 51.

Fourth floor building No. 2, 8 bays, one line sprinklers in bay, about nine feet on a line, equals total on floor, 40.

Fifth floor building No. 2, 4 bays, five lines of sprinklers lengthwise of building about eight feet on a line, equals total on floor, 40.

Total sprinklers covering fire area, 261.

Situation Preceding Fire. Mill closed down at 12.05 p. m. By 4.30 p. m. practically everyone had left the mill except watchman and one foreman on third floor building No. 4 (where fire started). A little before 5.30 p. m. as the watchman was finishing sweeping stairway a woman in the street shouted to him that the mill was on fire. Smoke could then be seen coming from windows in building No. 4. The watchman hastened for key to turn in fire alarm, but in the meantime alarm was sent in by a passing policeman. Meanwhile the sprinkler alarm was ringing. The engineer was up the street a short distance and hearing of the fire went directly to the mills.

First Alarm of Fire. Six companies responded to first alarm. All the floors in building No. 4 seemed quite free from smoke except the third floor and it was here that fire was first seen, in front of the last window in building No. 4 nearest corner of building No. 2. This space was clear except three or four turning poles where boys had been turning the stockings. Immediately south of this window were the frame racks made of two and three-inch slats, built from floor to ceiling or hung from ceiling in part. These racks formed pockets or tills from two to three feet square which were used as stock bins for stockings in the gray. These bins of course greatly interfered with distribution from the sprinklers and the stockings absorbed a great deal of the water. Just north of the window and aisle where fire started yarns, finished goods, and so forth, were kept in cases and at time of fire there was said to have been considerable stock here. This interfered with the distribution here but also served as a wall, preventing the fire from spreading north to the beltway and also the belt openings in brick wall to adjoining building No. 2, which were very poorly or entirely unprotected. Everyone who could be seen and who was on this floor at this time said the sprinklers were operating vigorously and that everything was soaking wet soon after fire started.

After about 20 minutes the firemen decided that the fire was out or practically so and one of the officers ordered the sprinklers shut off. The engineer refused. He volunteered, however, to show the chief where the controlling valve was located (this was on the fifth floor, building No. 2). The two men started to shut the valve, but when they entered this floor they found so much smoke and heat that they were forced to beat a hasty retreat. The sprinklers were therefore not shut off. About this time fire suddenly broke out on the fourth floor, building No. 4 and began to spread rapidly. The fire pump had not been started and was not started at any time during the fire.

A second alarm was sent in at 5.58 p. m. and two more followed rapidly at 6.07 p. m. and 6.09 p. m., 18 companies and six trucks being the total number responding.

The firemen fought desperately and there seemed to be an abundance of water. The fire, however, spread rapidly over the fourth floor of building No. 4, up through the beltway at the north end of this building to the fifth floor, through the belt hole in the fire door communicating with building No. 2 on the fourth floor and across the corner windows over one-story building No. 3 to fourth and fifth floors of building No. 2. This, however, was the extent of the fire. The roof

over the stairway at north end of building No. 4 was partially burned through and roof along the south wall of building No. 2, also a medium-sized hole in south slope here burned through, the remaining roofs remaining whole.

At about 7.15 p. m. suddenly and without any warning the northeast corner of fifth floor building No. 4 gave way. The cross beams broke apparently by shearing, just inside the center columns taking in seven bays, tearing beams out of walls and leaving a perfectly clean break of about 56x20 feet. This floor took each successive floor in almost exactly the same place and all four floors went through into the basement with a tremendous crash. Several firemen were caught in this crash and one was seriously injured.

Why Sprinklers Failed to Control Fire, Etc. The fire apparently started in a perfectly open space on third floor, a narrow aisle as it were, with stockings in racks, to ceiling, immediately on the south, case goods on the north, open space on west and brick wall, with window and steam pipes under on the east. Three or four turning poles between case goods and aisle and two sprinklers over aisle. There is no explanation as to the cause.

Failure of sprinklers to control fire on this floor may be attributed to "obstruction to distribution" from stock of stockings in racks built to ceiling and well filled immediately at south of space where fire is thought to have started. The fire burned here for 20 to 25 minutes and opened 38 sprinklers. About 18 pounds static pressure obtained on this floor and, roughly, 38 sprinklers allowing a flowing pressure of only five or six pounds will discharge 500 gallons a minute. This would take only 20 minutes to empty the 10,000-gallon gravity tank.

If estimate concerning the emptying of the tank is correct, the water for the sprinklers gave out just about the time the fire appeared in the fourth floor and so, from this point on, no aid was given by the sprinklers. All the heads on the fourth and fifth floors of both buildings were opened with one exception and this one exception was located about the center of the fourth floor, building No. 4. No reason is apparent why this link did not give way. A good many sprinklers were examined which had operated apparently satisfactorily and the pipes seemed tolerably free from everything except a little iron rust. In many instances small pieces of iron rust or scale were located in the sprinklers on the fourth and fifth floors in such a way as to indicate that no water had been thrown from sprinkler with any force at least.

Why Pump Was Not Used. Apparently, at first the engineer was too excited to think about the fire pump and soon afterward the order came to shut off the sprinklers. Evidently he considered his duty performed when he refused to close the valve. Besides these circumstances as nearly as could be learned there was not more than five or ten pounds of steam in the boilers at time of fire. No excuse for not getting up steam and putting pump in service could be given. In inspector's opinion, this is the one vital point in the failure of the sprinklers to control the fire or at least hold it in check on the fourth and fifth floors. There seems to be no doubt that the sprinklers held fire in check on third floor, where distribution was most interfered with, until

water gave out, but of course as soon as the water supply was exhausted sprinklers became worthless.

Damage. The chief damage was done by water and by collapsing of floors. In fourth and fifth floors, building No. 2, the only floors in this building entered by fire, the fire seemed to confine itself largely to the ceiling and roof. The looms and stock here were soaked with water. The fourth and fifth floors, building No. 4, seem to have suffered a little more by fire, but the machinery here was only damaged by water. Everything in buildings No. 2 and No. 4 on all floors was soaked, also building No. 5 and first two floors of building No. 1. Above the second floor building No. 1 very little damage was done. The insurance patrol saved a large part of the more valuable machinery by covering same.

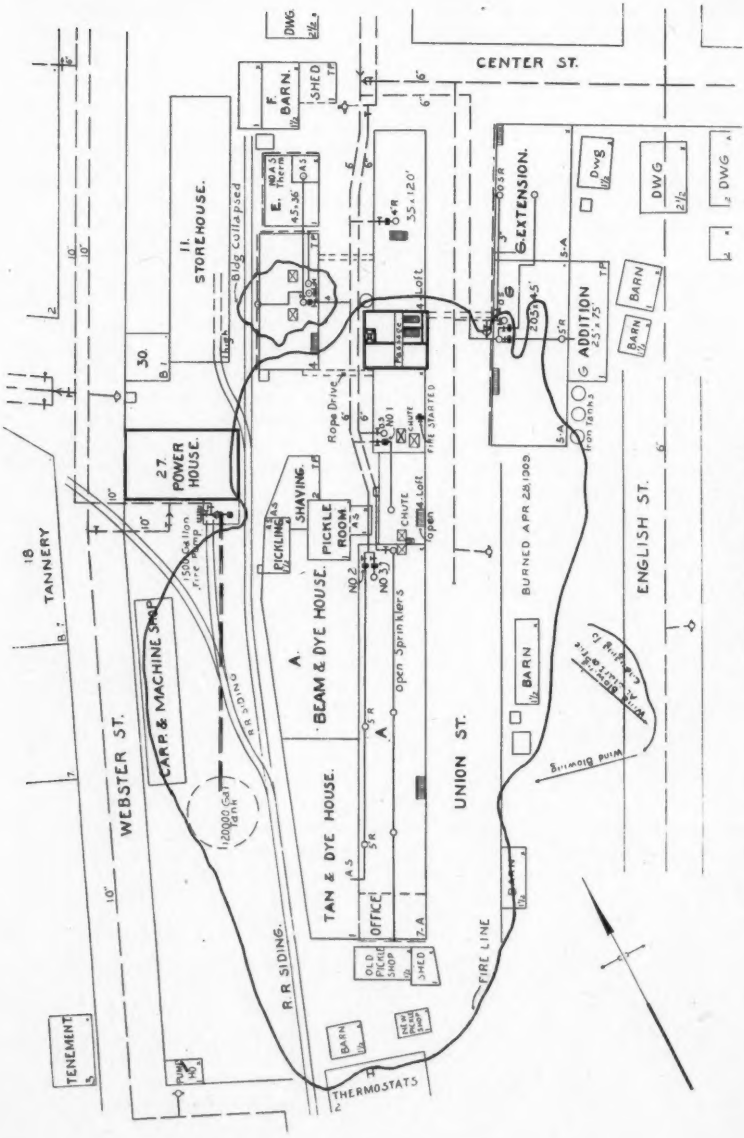
Floor Collapse. This area on the top floor was occupied by stock in cases piled nearly to ceiling and the probable reason for the failure of the floor is that after these goods had become water-soaked the weight was too great for the floor beams. These floor beams were continuous from wall to wall with a column in the center of space. Above the column each beam is wrapped with a ten-inch iron collar or band, the ends of the beams being set in the brick walls. These beams apparently sheared off just outside of the iron collar, the center of floor dropping first and pulling ends of beams out of brick walls, thus only disturbing a few bricks just above each beam setting. Of course when top floor fell the remaining floors fell in as fast as the load hit them, apparently failing in much the same way at each floor. Beams that failed were apparently not charred or burned over one inch deep.

Loss, about $40,000.

Summary: Insufficient water supply to sprinklers.

8435. Peabody, Mass. April 28, 1909. Tannery. Fire was discovered just before 3 a. m., Wednesday, April 28th, by the night watchman at a calf skin tannery adjoining. This watchman smelled smoke and upon investigation found the fire in the lower story of building "B" (see diagram). This room is used for buffing and shaving sheep skins. Building "B" was equipped with sprinklers. The watchman ran into the boiler house and found the local watchman who had not noticed the fire. They looked into building "B" and found a serious fire in progress. The Calf Skin Co.'s watchman asked the local watchman where his fire alarm box was and was told that he did not know, although the box was on the boiler house close by. The other watchman ran back to the Calf Skin Co.'s box and pulled in alarm. A few minutes later another alarm was pulled in by a milkman on the street.

The night fireman and the watchman at the Calf Skin plant immediately got their 1,500-gallon Underwriter pump under way and had streams on the fire before the public department arrived. The department arrived promptly and the chief at once gave the general alarm and called aid from Salem and Beverly, which cities sent one steamer each. The master mechanic of the Calf Skin Co. arrived promptly and at once opened the six-inch city water valve, supplying the 120,000-gallon cistern from which the fire pump draughted. He ran the pump full speed, supplying six streams at over 100 pounds pressure. The Calf Skin Co.'s men handled four of these, the fire department taking the others. The two



Sprinkler Fire No. 8435.

Peabody steamers supplied two streams each and the Salem and Beverly engines one each. Some streams were taken directly from the mains. In all 16 or 18 streams were used.

The fire spread very rapidly through building "B," probably aided by the open chute which passed up through the floors. Building "B" was of light joisted construction about 120x140 feet, shingled walls, open finish, with five main floors and an attic. Roof steep joisted, shingled, The walls of upper floors were open slats as the rooms were used for air drying. This construction is most favorable to rapid burning. The chief states that the fire was on all floors when he arrived and was working through building "A," which adjoined "B" on the south.

Building "A" was a large structure of the same general construction as "B." It was seven stories with two attics, 206x40 feet, with a one-story beam house adjoining, 250 feet long by 30 to 60 feet wide. Building "A" was not in good repair and had been shored up with heavy beams about 30 feet apart on one side. All the buildings were equipped with Grinnell glass disc sprinklers on dry systems, fed by liberal town mains 75 pounds pressure and small gravity tank. A considerable number of the sprinklers were corroded. The dry systems were large, there being over 500 heads on each dry valve.

Extent of Fire (see plan). Buildings "A", "B" and adjoining sheds were totally destroyed. The southerly ends of buildings "G," "C," and "D" were burned out and practically the entire buildings were wet down. Fire ran through the peak and west eaves of "G" for about half its length. Building "D", although not burned, collapsed, probably from the added weight of the wet stock. This building was four stories high but had an old roof between second and third stories which left a large hollow space. Although this space was sprinklered fire might have weakened a post within it and caused the collapse. Only about one-third of "D" remains in good condition. The engine room roof has fallen and that of the boiler house is considerably burned.

Fire extended to adjoining property as shown on plan. By the excellent work of the men and the pump at the Calf Skin Co.'s plant the fire did not gain headway in that property. The exposure from the burning eight-story tannery must have been extremely severe and the work of these men cannot be too warmly praised. Their boiler house and fire pump house was within 30 feet of the burning beam house and but 80 feet from the big eight-story tannery, yet they stuck to the pump and to the boilers which supplied it with steam. The windows of the boiler house were broken out by the heat and hose streams. The fact that the pump was located in a fireproof room, mostly underground and provided with a metal skylight glazed with heavy glass was considerable of a factor in making it habitable. The men in the pump room say that flames roared over their heads and the heat radiated through the skylight so as to make the room very uncomfortable.

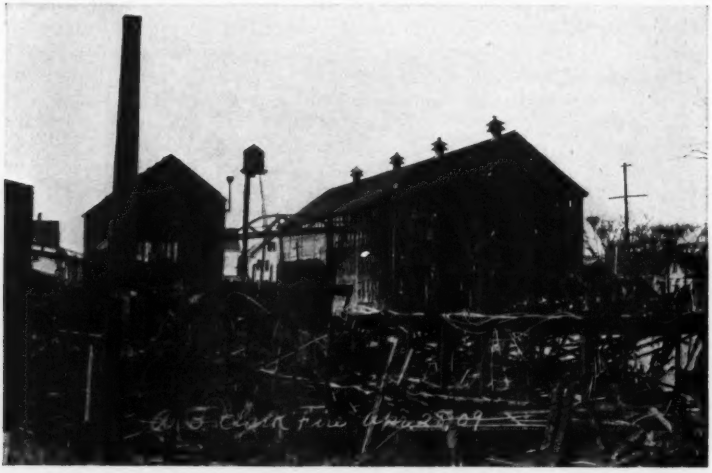
The east side and roof of the Calf Skin Co.'s carpenter shop was burned and will need replacing but no fire reached inside the building. The large wooden storehouse, drying building No. 18, seven stories high, was within 120 feet of the fire and directly in its path, yet by the excellent streams from the pump the men were enabled to keep the entire building wet down. The paint is scorched and many windows cracked but that is

the extent of the loss. A steady patrol was kept up throughout all the rooms of the Calf Skin property with the result that several fires from flying embers were promptly discovered and extinguished. The good judgment shown by the employees of this plant undoubtedly saved a large loss.

Weather. The wind was light. At first it blew in a southeasterly direction then veered around, blowing westerly, which carried the fire toward the Calf Skin plant. A heavy rain had been falling from the early morning, which was a most fortunate occurrence as all the roofs were wet and sparks were quickly extinguished. But for this, the fire probably would have reached the proportions of a conflagration.

Sprinkler Protection. The chief of the fire department (after the fire) ordered all the sprinkler valves closed to prevent waste of water and all were found shut when examined by the inspector about 10 a. m.

Sprinklers in building "B" were controlled by a six-inch Grinnell



Sprinkler Fire No. 8435.
Showing ruins of tannery, and buildings partially saved.

differential dry valve. Examination of this valve after the fire shows that it had not left its seat. The latch of the valve was found in good condition. This is almost positive evidence that no water passed through valve. The evidence of the firemen and employees indicates that the sprinklers in "B" were not working during the fire.

The dry valve controlling sprinklers in north end of "A" (marked No. 3 on plan) was found up on its top latch fully open.

The dry valve (No. 2 on plan) controlling remainder of "A" and the tan yard and beam house was found on its seat, no water evidently having passed it. The latch was in good condition.

Examination of the gate valves under the dry valves shows the following:—

The hand wheel of the valve for building "B" was broken off, leaving the spindle only. Valve was closed and it would have been impossible to have closed it after the fire without the use of a pipe wrench. The stem bore no marks of a wrench. Examination of the slide indicator showed that the word "shut" had apparently been exposed to more heat than the word "open."

Valve No. 2 was a slide indicator. The indicator was not in working order. It may have been broken in the fire or have been one of those formerly destroyed by corrosion. The word "shut" appeared to have been exposed more than the word "open." The dry valve above was the one in which the babbitt metal was found melted.

Valve No. 3 was an outside screw valve. The condition of the screw would indicate that the valve was practically closed but as the dry valve above it was found open the evidence is conflicting. The dry valve might have tripped prior to the fire and the system have been shut off to await a convenient time to put it in order again.

Some of the valves on drip pipe above the dry valves were fused. This would not have occurred had there been water on the system.

The valves in the other buildings apparently had all been open.

We can only conclude from the evidence that the valves beneath the dry valves were closed in building "B," on at least one of the systems in "A" and probably on both. The dry valves might have been water columned or might have stuck to their seats. The latter is extremely unlikely as these valves have frequently tripped during the past few years owing to leaks of air. The former is not probable as the babbitt metal of one seat ring was found melted out, indicating that no water flowed through valve.

The sprinklers were corroded in most of the lower rooms and an argument might be advanced that they did not open until the water pressure was reduced to such an extent as to be insufficient to lift the valves from their seats, but this is hardly possible as no shortage of water was noted and the other valves opened properly much later in the fire. Moreover, the spread of the fire was so rapid that some heads must have soon opened to allow air to escape if system had been in order.

The man in charge of fire appliances states positively that all valves were open but he also stated that he opened all valves to open sprinklers, forgetting, until reminded of the fact, that it was impossible to get to valves in "A" and "B" when he arrived on the scene. He also neglected to state how, after the fire, he closed the valve which had the hand wheel broken off. The fire chief ordered this man to close all valves after the fire, so unfortunately he is the only person who can give evidence regarding the valves. Considering the evidence and the fact that inspectors have found valves closed repeatedly at this plant we can only conclude that they were closed at the time of the fire.

The dry valves in buildings "C," "D" and "G" tripped and the sprinklers were an important factor in aiding the firemen to save these buildings. The sprinklers in the roof of "G" did not do very good work but probably the pressure was greatly reduced at this time on the yard pipes, as steamers were drafting from the street mains and service pipes had been broken.

It is remarkable that the fire was stopped in these highly combustible buildings so heavily exposed.

Inspector found two firemen who stated that some of the open sprinklers were working, but could not learn just which ones were used or positively whether any were operated. In any case they evidently were not a factor in the protection as the rain kept the roofs wet and fire passed the open sprinklers, getting into the buildings by the window openings.

The Calf Skin Co.'s pump was an excellent protection for these buildings against exposure as the hose lines were used to attack the fire before it actually reached their property. Building "D" was saved in this way. If it had burned the large storehouse No. 11 would undoubtedly also have burned.

The fire was under control by 5 o'clock. The fire pump ran three hours, probably nearly two hours at full capacity. Had not the water been turned into the cistern, the supply would have lasted but one hour and twenty minutes, so the wisdom of the mechanic's prompt action is apparent. The small gravity tank (10,000 gallons) was exhausted and was not a factor in the protection.

The underlying causes of the loss of this risk were,

1st—The existence of large dry pipe systems in poorly constructed buildings. The floors had settled and thrown the piping out of line, which, as it was not kept in repair, resulted in continual leaks, making it impossible to keep the systems in working order for any long continued period.

2nd—The care of fire appliances was poor. No serious attempts had ever been made to overhaul the systems and keep them in good order. The defects of the risk have been pointed out in previous reports. The valve to building "B" was found half shut at August inspection.

The loss will probably be in the vicinity of $300,000. The loss to the Calf Skin Co. will not exceed $1,500.

The cause of the fire is not known. At the last inspection inspector called owner's attention to an accumulation of rubbish and dirt in the first story of "B."

Summary: Defective equipment.

8434. Lowell, Mass. May 15, 1909. Shoe Factory. At 11.47 p. m., a policeman saw a light in the corner of the third floor of the main building and rang in the fire alarm box at the corner. Meanwhile the fire had spread throughout the whole end of the building. The fire apparently started from an unknown cause in or near a metal waste barrel which stood in the easterly corner of third floor near elevator.

At 11.49 Hose No. 9 reached the fire and at once directed two streams in the corner of the building where the elevator is located, devoting their energies to keeping the fire from spreading down the elevator to the second floor where excessive quantities of paper tubes and paper tube waste were stored. These men did not notice whether the sprinklers were in operation or not. Firemen from other stations reached the fire shortly afterwards and carried lines in through the other end and sides, and they state positively that the sprinklers were not in operation on the third floor when they entered the building. The firemen did very good work and the dismissal was given at 2 a. m.

The water supply was adequate and no defect was noted except the breaking of the stem of a three-way hydrant.

The thermostat system had recently undergone extensive repairs, and a Wall testing device had been installed. The thermostats were tested the day of the fire and showed no defect at the fire station. The thermostats did not ring at the fire station at the time of the fire, and patrolman giving alarm states that bell was not ringing on front of factory, but by the time the near-by hose company had reached the factory, probably three to five minutes after fire started, the thermostat bell on the front of the factory was ringing. Thermostats were the Watkins improved type (1899), unapproved spacing, and it is not known why they failed to operate promptly.

April 13, at 8.16 p. m., there was a small fire in approximately the same location in which this fire originated, cause reported to be spontaneous combustion. This fire resulted in a loss of $120, and was extinguished by the sprinkler system by the time the fire department arrived.

In the present fire the sprinklers apparently failed to operate and were of no assistance in extinguishing the fire.

When the inspector visited the plant, May 17, he found that the valves had been handled by other people before that time. The following facts, however, are of importance.

One of the members of the fire department, by direction of the chief, at about 12.15 a. m., Sunday, May 16, closed the main gate valve below the alarm valve on the city connection, in the southerly corner of the first floor, and the valve under the tank controlling the tank supply. These two valves were of the indicator pattern, and the brightness of the stem under the indicator follower in the "open" position, showed that they were usually open. The valve at the foot of the main riser on the first floor and the valve controlling the second floor, and the two valves controlling the third, are not of the indicator pattern, and there is no evidence to show in what condition they had been kept. The cold weather valve controlling the sprinklers in the tower, was closed at the time of the fire (proved by the fact that while the struts had melted from the sprinkler heads, the glass buttons had not left their seats). The superintendent of the waterworks states that he examined, on May 17, the gate valve in street in connection pipe to sprinklers and found this open, with no evidence of its having been closed, and that there had been no occasion recently for closing it.

The sprinkler pipes in the southeast half of the third floor show that they became red-hot during the fire; the sprinkler heads on these pipes show evidence of great heat, these two facts indicating that no water was flowing through the pipes at the time of the fire.

After the fire there were three feet of water in the tank, and the appearance of the tank did not seem to show that the water had been above that level for some time. Condition of other valves in the building, particularly the one at the base of the main riser, and the two valves controlling the third floor, is questionable, but it is doubtful whether the two latter were open and this may be the reason the sprinklers failed to control the fire. Fire department inspector reports that

he found these valves closed on Monday morning, May 17. The valves in the building were not kept strapped open, although inspector had requested, March 16, that they be so kept.

Valves were evidently open on the date of the April 13th fire, and the main gate valve on the first floor and the valve under the tank were probably open at the time of this fire.

Spread of fire to second floor was largely prevented by elevator enclosure (⅞-inch wood) and enclosed stairway (⅞-inch wood), both very near origin of fire. Prominent defects brought out by fire are: lack of proper supervisory system for sprinkler equipment; deficient thermostat system; the former defect is undoubtedly responsible for the large damage done.

Sprinklers installed in 1897; 95 in room, all opened on third floor, one in stairway second to third floor at southeast end, and several in tower. Pipes installed in 1897, pipe sizes 1896 standard. Spacing and arrangement of sprinklers, mill construction, ten feet apart in ten-feet bays; no obstruction to distribution. Wet system where fire occurred. Primary water supply, city waterworks, 54 pounds pressure.

Fire was very well managed by public fire department. Practically total loss on third floor, heavy water damage only on first and second floors. Loss, $50,000.

Summary: Defective automatic fire alarm. Defective sprinkler equipment.

8439. Milton, N. H. June 10, 1909. Paper Mill. This was an old, basement and two-story, frame mill of joist construction. Elevators and stairs, of which there were several, were all open. Boiler house was brick, adjoined main building, and not cut off. Raw stock was waste paper, wood and sulphite pulp, with the former stored in large quantities, loose and in bales through all parts of the buildings without regard for cleanliness.

Cause of fire unknown.

Plant totally destroyed except storehouse, which was saved by good work of country fire department with small hand tub. Mill was shut down for repairs. These were completed and work was to have been resumed the following morning. Night watchman went away for the day, and was to report at or before 7 p. m. but did not. The superintendent claims to have made a round at 7 p. m., and saw nothing out of the way, after which he went home to supper leaving mill alone. At about 8.30 he started for the mill to see if the watchman was on duty, and discovered the fire and gave the alarm by whistle at near-by mill, after trying to enter mill which he was unable to do on account of smoke.

By the time the fire department arrived (ten minutes), the mill was afire nearly all over.

This mill had a fair sprinkler equipment (wet system, Grinnell glass disc, pipe sizes 1, 2, 3, installed 1901, spacing good), so far as it covered, but boiler house and other important portions were not equipped. Water supply was an 8,100-gallon gravity tank, and poor rotary pump. Inspector visited the risk the day previous to the fire and found the gravity tank empty and pump out of commission

Superintendent stated that tank was filled on the same afternoon, but no one could be found who noticed any water coming from sprinklers during the fire, although several employees entered the building attempting to save personal belongings. Rotary fire pump was of no value and no attempt was made to start it.

Loss, about $60,000.

Summary: Defective and incomplete sprinkler protection.

LARGE LOSS SPRINKLER FIRES.

Where Sprinkler Control is Satisfactory.

8426. Greensboro, N. C. December 23, 1908. Cotton Mill Warehouse. Fire started at 9.30 p. m. while plant was not in operation. Building was standard mill construction. The fire was discovered by employees at near-by store hearing water motor alarm of sprinkler system. Four hose streams from private system were laid, and 59 sprinklers opened. Risk equipped with dry system, Grinnell valve, air pressure at time of fire 35 pounds. Primary water supply was 75,000-gallon gravity tank; static pressure of sprinklers which operated 40 pounds. Steam pump was called in requisition and aided in extinguishing the fire. Sprinklers in operation two and one-half hours, held fire in check. Cause probably fire in cotton when it was put into the warehouse. Loss, $8,000. Operation of sprinkler system satisfactory.

Summary: Obstruction to distribution from bales of cotton.

8427. Philadelphia, Pa. April 6, 1909. Manufacturing Druggist. This fire occurred at 8 p. m. on the third floor in room equipped with wooden closets about eight feet square and six feet high, used for pulverizing vegetable roots, charcoal, and so forth, for druggists. The grinding or powdering mills are contained in these closets which are not equipped with sprinklers. The substances are allowed to deposit on the closet floors. On the day of the fire charcoal was being powdered and took fire without prompt discovery. The fire in the charcoal set fire to the wooden closet but the action of the sprinklers prevented the spread of fire in the room outside, beyond the charring of the floor supports overhead. The contents were thoroughly soaked with water, both from the sprinklers and the streams directed by the firemen. Several of the firemen being overcome from the gas of the burning charcoal, the entry of the department to the room was retarded and considerable unnecessary water was thrown into the building through the windows. Twenty-seven sprinklers in all opened and were probably in operation about an hour. Gravity tank was only partially emptied. Sprinklers undoubtedly held fire in check and were a factor in extinguishing the fire, which was evidently out before charcoal fumes allowed firemen to enter to discover the fact.

Loss, principally water damage, about $12,000. Sprinkler operation satisfactory.

Summary: Incomplete sprinkler protection. Closets containing grinding mills not equipped with sprinklers.

8425. St. Louis, Mo. April 8, 1909. Chair Factory. Fire occurred at 5.30 p. m. while plant was in operation. Building was of

brick joist construction. The fire entered from exposure to adjoining building on fourth, fifth and sixth floors. Ninety-nine sprinklers on the fourth floor, ten on the fifth and three on the sixth promptly opened and held fire in check until the city fire department could assist in its extinguishment. Loss, $12,000. Operation of sprinklers satisfactory.

Summary: Exposure fire.

8428. Philadelphia, Pa. April 3, 1909. Bag and Twine Factory. Fire started at 5.15 p. m. while plant was in operation. Several metal conduits, containing electric wires, from a dynamo, are run underneath engine room floor together with exhaust steam pipes, and so forth. This space is more in the nature of a tunnel that a basement and is not sprinklered.

The fire started almost directly under dynamo, in tunnel, and it is not known whether the cause was oily waste or dirt which possibly may have come in contact with steam pipes or whether a short circuit was developed due to some defect in recently installed conduits.

The engineer stated that tunnel had been thoroughly cleaned out a week or so before fire and that he was inclined to favor the short circuit theory.

Fire gained considerable headway under floor before it was discovered. The engine room floor consists of one-inch boards on joists and is considerably oil-soaked and fire did not have much difficulty in burning through floor, near the place where it evidently started. From this point fire spread throughout engine room and opened all 17 sprinklers in this room, wood ceiling over each sprinkler showing a clean circle where sprinklers had acted, balance of ceiling being considerably charred.

At one end of the engine room a large beltway communicates freely with second floor of adjoining building and the fire followed up this beltway into second floor of adjoining building. The sprinklers in the immediate vicinity on this floor held the fire very close to beltway but the heat from the fire in engine room coming up beltway opened 29 sprinklers here, making a total of 46 sprinklers opened. Seventy-five thousand gallon gravity tank, eight-ninths full, still had about six inches of water after fire. Static pressure on sprinklers 35 to 40 pounds. Fire extinguished by city department.

Loss, $20,000, principally from water.

Summary: Incomplete sprinkler protection. Tunnel under engine room not sprinklered.

8424. New York, N. Y. April 19, 1909. Fur Garment Making. Fire occurred at 10.45 p. m. while plant was not in operation. Starting in cutting department on the top floor of 12-story building. Fire may have been caused by lighted cigarette or match in rubbish under cutting table. Smoking allowed about the risk, tenants stating that they would be unable to keep their employees otherwise. Claim was made that no smoking was done in manufacturing sections however. Three sprinklers opened in the room in which the fire started, the cutting tables offering some obstruction to the distribution of water. Four thousand gallons of water reported to have been exhausted from the pressure tank. Sprinklers practically extinguished fire but after

fire department arrived considerable water was used from standpipe to quench glowing embers after sprinkler valve was shut off. Top floor loss where fire occurred not great, but $10,700 worth of leather goods in basement were damaged. The loss in basement, due to susceptible stock of leather goods, was caused by water from leaky elbows in the six-inch standpipe line connected to fire engines on outside. This pipe was poorly laid out, requiring five 45° elbow joints in front part of basement. Operation of sprinkler system satisfactory.

Summary: Water damage due to leaky standpipe.

8430. Saco, Me. May 14, 1909. Cotton Mill Storehouse. An employee in the top story of the mill saw smoke coming out of the storehouse windows. The picker hands immediately carried two small hose streams into the storehouse while others got out three lines of large hose from hydrants in yard. The fire was located at one end of the building on the second floor in a pile of slubber roving on bobbins. As the fire made a dense smoke a public alarm was given and the city department added two lines of hose. The fire passed through the ceiling to the third floor, damaging some of the colored cotton in bags. Eighteen sprinklers in the second and third floors opened. It is stated that the six-inch Grinnell dry valve operated promptly and that the alarm was heard shortly after the fire was discovered. At 6.30 p. m. the water was shut off of the sprinklers as the fire was considered out. Men began removing the roving but at 7.45 the fire broke out again. A man was sent to open the valve admitting water into the sprinkler system and two lines of hose were used. This fire did not last very long. There was no damage to the fourth floor. In the third 10,000 pounds of colored cotton in bags was damaged, principally by water. The second floor is used for the storage of surplus colored slubber roving on bobbins and finished roving in bins. There were also 50,000 bobbins in boxes stored in the room. The fire destroyed some of the roving but the damage was mostly by water. In some cases, the hose streams tore the roving away from the bobbins. Eighty thousand pounds of slubber roving and 25,000 pounds of finished roving were involved. There were 102,500 bobbins including those on which the roving was wound. In the first floor 275 bales of cotton were wet. The damage to the building was not large. As the pressure was considered sufficient to supply the sprinklers and hose streams, the pumps were not used. The fire was undoubtedly caused by the roving being piled up around a pendant incandescent light. The storehouse is to be re-wired, approved wire and fittings being used and lights are to be re-located at ceiling. Dry system operated satisfactorily. Loss (estimated), $12,000.

Summary: Principally water damage to contents.

8429. Minneapolis, Minn. May 21, 1909. Mercantile (House Furnishings). Employee working in the store after hours discovered the fire on third floor of four-story brick building and turned in an alarm on the A. D. T. box on first floor. About the same time a runner from the A. D. T. office was there in response to the signal for low pressure on the riser. Owing to the heavy smoke generated the firemen had difficulty in getting close enough to definitely locate fire,

hence it was an hour and 12 minutes after alarm was sent in before sprinklers were turned off. The city department extinguished the fire, although the sprinklers undoubtedly held same in check, 27 being in operation over an hour, emptying two 5,000 gallon pressure tanks until city pressure equalized. Dry valve was of Grinnell pattern with air pressure at time of fire 35 pounds. Static pressure on sprinklers which operated 85 pounds from tanks, 60 pounds from city. Sprinklers, Grinnell glass disc.

It developed during the investigation that a load of new mattresses had been received the day of the fire from a local bedding factory and that in the shoddy mill of this factory fire was smelled at the time the cotton of these mattresses was picked. There was not fire enough to be detected however and nothing further was thought of it. It is thought that a small spark was imbedded in the mattress when made up and did not find its way to the surface until the mattresses had been delivered and laid in a pile several hours. Once out, it found a comparatively protected path between mattress pile and frame partition. It also travelled in joist channels between sprinkler heads placed regularly—not staggered—under open joist ceiling. Twenty-seven sprinklers opened on the third floor and 16 on the fourth after fire broke through floor. Fire damage was comparatively small.

Loss, principally from water, $60,000.

Summary: Obstruction to distribution and defective spacing of sprinklers.

OTHER SPRINKLER FIRES OF ESPECIAL INTEREST.

8422. New York, N. Y. June 16, 1909. Piano Factory. Fire occurred while plant was in operation. Complete report on buildings and equipment and story of fire follow:

Construction. One, two, four and five-story buildings, inter-communicating, and covering a total area of 23,245 square feet. Areas divided as follows:

Sprinklered factory—7,150 square feet; unsprinklered factory—four-story section, 7,875 square feet, two-story section, 3,360 square feet; one-story section, 3,740 square feet; one-story boiler and engine house, 1,120 square feet.

The five-story sprinklered building is divided into two areas, 4,150 square feet and 3,000 square feet, by a brick wall (division) with sliding batten door at each opening.

All buildings were brick, ordinary construction, single floor boards, open finish, gravel roofs and numerous thin glass skylights. Stairways and hatchways were mainly open and poorly enclosed. In some cases hoist openings were protected with ordinary hand traps only. A large number of belt openings were not in any way cut off.

With the exception of wall between sprinklered and unsprinklered buildings, all division walls were perforated with open arches, unprotected window openings, belt openings, and so forth. Practically all of unsprinklered area subject to one fire.

Two peculiar features of construction and arrangement were prominent and had much to do with the rapid spread of flames:

Sprinkler Fire No. 8422.
View showing large unbroken area.

Sprinkler Fire No. 8422.
Looking from roof of adjoining building, showing spread of fire through inter-communicating one-story sections. Sprinklered building in background, showing angle where fire attacked same.

(1) Buildings were without basements and first floor boards were elevated from one to four feet above the earth to meet grade at streets, leaving a concealed space under floors. This space in all probabilities communicated through archways in division walls to adjoining areas and also in pit or submerged enclosure used for storage of oils, varnishes, and so forth.

(2) The four-story building (unsprinklered) lay at right angles to the sprinklered building with unprotected window openings in the unsprinklered buildings diagonally opposite windows in the sprinklered building at apex of angle protected only with iron shutters. This arrangement afforded the opportunity of a severe attack on the sprinklered building from the unsprinklered building. There was also one window opening with iron shutters at fifth floor in sprinklered building, overlooking roof of unsprinklered section.

Sprinklered and unsprinklered buildings communicated on second and fourth floors through one doorway each, protected with double, automatic, sliding, three-ply standard fire doors, evidently in fair condition. A similar doorway on fifth floor opened from sprinklered building onto roof of unsprinklered building and was protected by a single, automatic, sliding, three-ply fire door on one side and by hinged two-section three-ply standard fire doors, not automatic, on outside of wall.

Exposures. Buildings were not seriously exposed, but on the contrary the unsprinklered section formed exposure to another piano factory diagonally across the street and about 80 feet away.

A good three-story brick stable and bottling department belonging to a brewing company adjoining east end of the unsprinklered buildings was seriously exposed by the latter buildings, but withstood the severe attack owing to parapet walls five feet, six inches high and wire glass skylights over top story.

Occupancy. All buildings were occupied as a piano factory. The mill work, heavy woodworking, lumber drying, and so forth were all located in the poorer class of buildings, the unsprinklered sections.

The finishing, assembling, stringing, storage and offices occupied the protected building.

Boiler house, machine shop, engine rooms, shaving vault, and so forth, were all a part of the one-story sections in rear of unsprinklered building. Blower system was antiquated and pierced floors throughout. Shavings vault was not standard and general arrangement of occupancy was unsatisfactory.

All machinery was belt driven from engine plant and steam heated caul boxes were promiscuously located throughout the unsprinklered building.

The bulk of the varnishes, oils, turpentine, and so forth, were used in the unsprinklered sections and the numerous explosions and sudden bursts of flame witnessed during fire were good evidence that little care was exercised in the handling and storing of this material.

Outside Protection. City fire department. Public fire alarm box near risk. Ten fire hydrants all within 500 feet of plant. Accessible on two streets and in open yard to fire apparatus. Accessible to fire boats, being but 450 feet from river.

Inside Protection. Practically none in unsprinklered buildings

Sprinkler Fire No. 8422.

Fourth story, showing communications to sprinklered building. Note sill and fire door torn from wall.

other than a few scattered pails. Good watchman and clock service covering all buildings at night and on Sundays and holidays. There was also an equipment of Harkness sprinklers throughout a greater part of these buildings, with a small gravity tank as the only source of supply. The equipment had for sometime been entirely out of commission, with valves throughout kept closed on account of the system being old and fear on the part of the tenant that water damage might be experienced.

Sprinklered building protected with automatic sprinklers, fair sub-standard equipment, fire pails, watchman and a public fire alarm box in office.

Sprinkler Equipment. Wet pipe system, installed in 1903. All portions of building sprinklered and only nine heads in driveway through first floor shut off during cold weather. Spacing, good, staggered under open joist on fifth floor, but not staggered under wood ceilings of second to fourth floors. Pipe sizes, 1896 standard. Practically no obstruction to distribution other than a few polishing tables about 8x6 feet on fifth floor.

Two risers, one three and one-half inches in front section and one three inches in rear section, both uniting in fifth story, with four-inch drop from a 7,500-gallon wood gravity tank, elevated 16 feet above highest line of sprinklers, and giving 12 pounds pressure at that point.

Main gate and check valves in tank drop, fifth floor, and gate and alarm valves each floor in each section. Alarm valves are of the Grinnell branch type and are connected to outside bell and to bell and annunciator in engine room.

Aside from gravity tank, the only supply to automatic sprinklers is an outside single three-inch steamer connection for use of the fire department, connected with base of risers by means of a three-inch pipe.

System is arranged to be controlled by gate valves as above described, on each floor of each section and at gravity tank, there being 13 gate valves in all.

Referring to the particular section in which sprinkler heads operated, the arrangement was as follows:

On third and fourth floors, smooth wood ceilings, spacing as above described. Thirty-two heads in each area on three-inch riser, three-inch alarm valve and three-inch gate valve. Pressure from gravity tank 20 pounds on third floor and 16 pounds on fourth floor heads.

Story of Fire. On Wednesday, June 16, 1909, at about 10.30 a. m. some four or five employees, including engineer, discovered smoke issuing from between floor boards of first floor in the unsprinklered building near rear yard and also near angle formed by adjoining sprinklered building. Fire at that time was evidently only smouldering in the concealed space under flooring, as no flames could be seen. Its origin is unknown.

In an effort to extinguish fire, the engineer and numerous employees began to pour water from fire pails down through cracks between floor boards. It was soon evident that fire was spreading about in this concealed space and engineer telephoned to fire headquarters, following this call by a public fire alarm box call which was recorded at 10.43 a. m.

Statements as to the rapidity with which fire spread between this time and the time of the arrival of apparatus differ greatly. It is claimed by the engineer and others on the premises that fire was still within this space when firemen arrived but that little spurts of flame were visible here and there about floor, coming through cracks in all directions. It is their further claim that the introduction of a line of hose into this space forced the flames suddenly toward elevator shaft where they soon spread throughout the entire building. On the contrary, the firemen and outside eye-witnesses claim that flames were pouring out of first and second story windows when fire apparatus arrived. In any event, the rapid spread of

flames can well be realized when it is noted that at 11.30 a. m. (less than one hour after alarm was given) all unsprinklered buildings, including the one-story buildings in yard were practically consumed. Five alarms had been sent in and two fire boats were at work from the river at foot of street; several walls had fallen and roofs caved in and considerable difficulty was experienced in holding flames from crossing street to the sheds and buildings opposite.

Flames spread so rapidly that the iron shutters in east wall of the sprinklered building could not be closed and the latter building was about this time attacked across angle at these openings. Fortunately, the shutters at fifth floor window overlooking the fire had not been opened at this date.

Sprinkler Fire No. 8422.

Inside third story of sprinklered building, showing windows at angle wall. Ten sprinkler heads operated on this floor.

The fire doors at communications were all open at time of fire but were closed by hand before flames could enter at these points.

The third floor first received the attack at windows across the angle and one by one four windows gave way, and almost simultaneously with them ten sprinkler heads operated. This was at about 11.30 a. m. Not many minutes after, one window on fourth floor gave way and immediately after one sprinkler operated.

The operation of these 11 sprinklers was in a way hastened somewhat owing to the fact that firemen opened the fire doors in rear wall and punched the glass out of several windows so as to fight fire from within the sprinklered building.

The outside door, at fourth floor communication, was either dislodged by falling timber or else hardware at hangers did not withstand the strain, as door fell from face of wall into the fire and a large part of the brickwork together with the stone sill at doorway was carried away, leaving a serious gap under the remaining door. Flames threatened to enter at this point into the concealed channels between joists and between fourth floor boards and wood ceiling of third floor. Flooring on fourth floor at wall was therefore torn up and several openings were made in ceiling on third floor.

As above stated, ten sprinklers on third floor and one on fourth floor operated and were in operation for about one hour. Only 5,400 gallons of water were used from gravity tank with a pressure ranging from 20 to 16 pounds. Average discharge per sprinkler was probably 12 to 14 gallons per minute.

Effect. There is no doubt but that the operation of the 11 sprinklers saved the protected building. Without them, the firemen could not have held flames back from the window and door openings and could not have used these openings for the purpose of fighting flames.

Aside from the damage to fire door, wall, sill and flooring at rear and a few holes in wood ceilings and the tearing out of the window casings, this building received no fire damage. The water damage will, however, be severe, as second floor was filled with pianos ready for shipment and all of the stock on third and fourth floors was nearing the finishing point. There are some 30 or 40 pianos on second and third floors practically beyond restoration, being swelled out of shape and disassembled by the water.

Remarks. The fire described in this report demonstrates the following facts clearly:

(1) The hazard of window openings in a protected risk diagonally opposite window openings in an unprotected risk, without proper protection at windows.

(2) Unbroken areas, or division walls with no protection at openings, affording a rapid spread of fire from wall to wall and from one section to another.

(3) The hazard of unstopped vertical openings.

(4) The hazard of concealed spaces under floors.

Loss 75% of entire plant, building and contents.

MISCELLANEOUS FIRES.

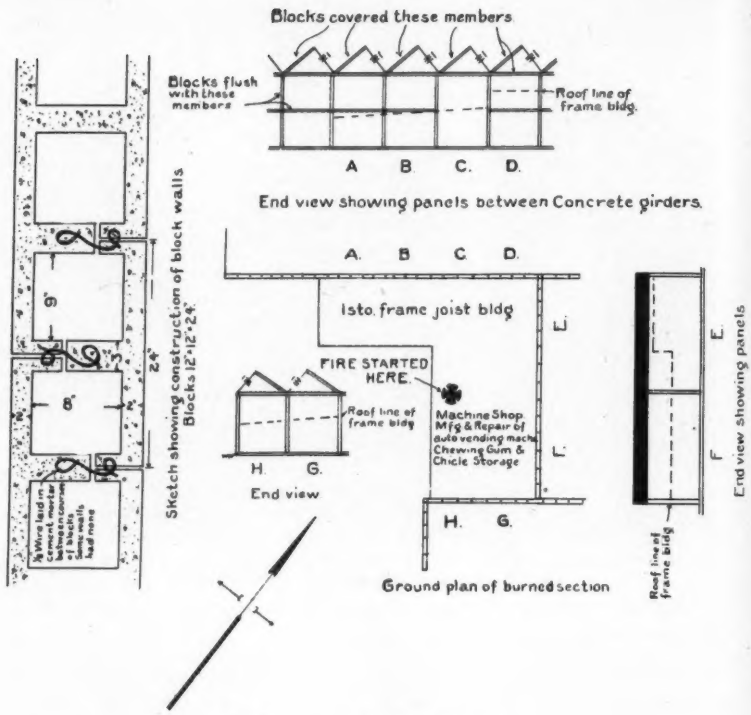
H-4085. Springfield, Mo. January 6, 1909. Theatre and Offices. Fire occurred in the division occupied as stores and offices at 12.35 a. m. and was discovered by occupant of building, who sent in an alarm over telephone. No watchman or alarm devices of any character were installed. It is believed that the fire occurred from escaping gas which was ignited in some manner unknown. Fire was attacked by city fire department, which used 2,000 feet of hose, two engines and one chemical. Considerable criticism was made upon the manner in which the department handled this fire and the department was subsequently entirely reorganized. The building was entirely destroyed involving a loss on building and contents of $145,000. (See photograph.)

Miscellaneous Fires Nos. H-4085 and 4087.

Showing ruins of theatre, and damage to adjoining hotel from unprotected window openings.

H-4087. Springfield, Mo. January 6, 1909. Hotel. This was an exposure fire set by burning theatre and office building adjacent. Fire attacked building through unprotected window openings, damaging woodwork and furnishings in about 40 rooms. Fire was fought from inside building with hose attached to inside standpipes, also from the outside by the city department. The building was of reinforced concrete construction and had the windows been properly protected against such exposure but little damage would have resulted. Owner claims damage to exposed building wall from intense heat. Loss claimed on building and contents, $42,000. (See photograph.)

H-4086. Stamford, Conn. May 27, 1909. Chocolate Factory. Fire at 6.40 p. m. Destruction of machine and woodworking shop and damage to concrete structure from exposure. Cause of fire unknown. Construction of main building: reinforced concrete beams, girders, floors and roofs, with concrete block walls between beams and girders; double concrete block construction with metal ties, some blocks flush with beams and girders, some covered beams and girders; reinforced in beams insulated by 2½-inch concrete; mixture 1, 2, 3½ and 1, 2, 4 for blocks and columns. Insulation of columns 2½-inch concrete, aggregate ½-inch to ¾-inch quartz gravel; fair sand. Floor and roof, reinforced concrete; no wood flooring; roof covering, composition tar. Finish of outside walls: columns, girders, beams, smooth finish; blocks, rough finish.


Blocks covered these members
Blocks flush with these members
Roof line of frame bldg.
A B C D.
End view showing panels between Concrete girders.
A. B C D.
Isto. frame joist bldg
FIRE STARTED HERE.
Roof line of frame bldg
Machine Shop Mfg & Repair of auto vending machs Chewing Gum & Chicle Storage
H. G.
End view
Ground plan of burned section
Sketch showing construction of block walls Blocks 12"x12"x24"
9'
8'
24"
E.
F
End view showing panels
Roof line of frame bldg

Miscellaneous Fire No. H-4086.

Sketch showing start of fire, character of buildings, type of construction, and so forth.

Panels "A" and "B". Blocks cracked and wall bulged.
Panel "C". Blocks badly cracked, many of outer blocks have fallen.
Panel "D". Blocks cracked somewhat badly, especially at sawtooth roof, where outer blocks have fallen.
Panels "E" and "F". Blocks fell soon after fire department arrived; wall entirely down except four or five rows of blocks at bottom.
Panel "G". Blocks cracked and wall bulged, outer blocks at sawtooth roof have fallen.
Panel "H". Blocks pulled down before risk visited; blocks badly damaged.

Story of Fire. Fire started in one-story, frame, joist building, which had recently been erected between No. 9 and No. 5, No. 6 and No. 8 (see diagram). The work consisted of manufacturing and repairing vending machines and was principally machine shop work with a little woodworking. There was also chicle storage (basis for chewing gum), and some oils and varnishes in the building. Fire started about 10 minutes after shut down from some unknown cause, all employees having left this building. There were men in the office and girls in the chewing gum department second floor of No. 9. Watchman had not started on

his rounds. Smoke passing through fire door at second floor No. 9 first alarmed the occupants and fire alarm was rung in while employees used standpipe hose, but without much effect. When department arrived the entire frame building was in flames and chief ordered a second alarm. Two steamers responded and three hose streams were used. It was useless to try to save frame building and efforts were directed toward preventing fire from entering main factory buildings. In this the fire department was successful, but not because of any special fire resistive qualities of the concrete block walls, for these walls at Nos. 7 and 8 collapsed inward soon after department arrived either from the effect of the fire or from hose streams, though chief gave orders to play as little water as possible on the walls. Walls at Nos. 9 and 5, 6 and 8 are also badly damaged and will probably need to be entirely replaced. Reinforced concrete posts and girders between which were set the concrete blocks were little damaged except main post in walls at Nos. 7 and 8. The edge of this is badly spalled for five or six feet of its length to a depth of two and one-half or three inches, so that upright reinforcing bars are exposed.

In other places the surfaces of beams and girders are spalled but not so as to impair their strength. The fire did not get into main building and except for a few wire glass skylights cracked and roofing melted the damage to concrete building is limited to the concrete block walls. These are practically all destroyed wherever they were in direct contact with the flames and the reason is not difficult to see after an examination of the construction.

There were no direct openings between frame and concrete sections except small ventilating holes at Nos. 7 and 8 and a fire door second floor at No. 9.

Construction Notes. A double concrete block was used, mixture 1, 2, 4 or 1, 2, 3½ (see sketch) a quartz gravel ½ inch to ¾ inch and a fair sand making up the aggregate. Cement, as far as can be ascertained, was good. Blocks made under supervision of New York contractor. The type of wall was especially weak. The sides of wall were bonded together by wires placed in cement mortar as each course of blocks was laid. It is doubtful if all of these walls contained this wire binder. The effect of heating up such a wall would be an expansion of the wires and consequent loosening of the wire bonds. Besides this, the expansion of the block walls themselves securely imprisoned as they were between posts and girders of reinforced concrete caused bulging and cracking of the wall, in some places diagonal shearing of the blocks, and in others chipping and spalling of the ends of adjoining blocks where the expansion of walls was excessive and the blocks weakest. The walls at "E" and "F" being the largest (panels about 48x24 feet) were the weakest, and fell early in the fire. The blocks in some of the smaller panels at "A" and "B" are generally in place while the high panels such as "C," "H," and "G" are badly damaged and are on the point of falling.

It is said that panels "C," "D," "E," "F," "G," and "H" were only temporary and may have been hurriedly mixed and put in place. These had not the cement finish on the outside as had the other walls.

There was a large value in machine shop, total loss being $150,000.

Main concrete building damaged to extent of $15,000.

This fire shows the inability of concrete or cement blocks of this

type to withstand severe exposure. The type of block and method of construction was undoubtedly inferior but had single blocks been used the result would probably not have been greatly different. Workmanship is a most important point and it is not believed that in this case it was of the best. Brick walls would probably have stood without showing the least signs of distress.

S-8423. Hartford, Conn. June 15, 1909. Incandescent Electric Lamp Factory. Fire at 11.30 a. m. in filament room of sprinklered building with brick walls; floor and roof of mill construction.

Fire occurred in room where carbon filaments are flashed in a gasolene vapor. Process consists of placing the filament, which forms a part of an electric circuit, in metal cup. The air is exhausted and gasolene vapor allowed to take its place. The gasolene is then shut off and the electric current turned on which heats the filaments to incandescence and decomposes the vapor from which the carbon is deposited on the filament. The switch is of a four point type making connection through mercury cups. It is also tripped automatically. The gasolene used is contained in a metal can holding about one and one-half gallons. The can is about eight inches in diameter, and stands on a long bench at which are five similar sets of apparatus, each set having an individual can. A rubber stopper through which runs a glass tube is inserted in the can and a rubber tube connects this with the apparatus.

Cause of the fire uncertain. It was claimed that the girl who runs the apparatus was reattaching the can which she had filled with gasolene when it was ignited by a spark from the trigger switch. In some way the can was tipped over, the contents running along the bench to the next machine when a spark ignited it. There was no explosion but the flame flashed up and back to the can. The foreman seized the blazing can and carried it out, his arm being badly burned in so doing. One sprinkler head opened, but the water, instead of quenching the fire, spread it the more. It was extinguished by hand chemicals. The fire department was called but the fire was out when it arrived.

Factory has been using this process for 15 years and has never had a similar accident.